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REPORTS

AND

OFFICIAL LETTERS

TO THE

KAITAKUSHI,

BY

HORACE CAPRON, COMMISSIONER AND ADVISER,

AND HIS

FOREIGN ASSISTANTS.

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TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

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NOTE.

The word Kaitakushi means: "Commission for opening up and developing;" and is the name of that Department of the Japanese Government that has charge of the settlement of Hokkaido (or Yesso and its dependent islands).

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OFFICE OF THE COMMISSIONER AND ADVISER
OF THE KAITAKUSHI.

March 15th, 1875.

His Excellency
KURODA KIYOTAKA,
Kaitaku Chokuwan,

DEAR SIR,

I have the honor to submit for your consideration the accompanying documents which form a brief summary of the work of the Kaitakushi since I entered upon the discharge of my duties in 1871.

The space at command and the voluminous nature of the reports and papers presented from time to time, have necessitated the publication of only the more important, and those, in several instances, in the form of abstracts. It is sufficient, no doubt, that this publication gives an outline of the operations of the department with enough particularity of detail to enable the general reader to obtain a correct idea of what has been done.

As a history of the Kaitakushi and its works, and as an authoritative account of operations that have been frequently misrepresented or misunderstood, I trust that this report will be of some value.

I have deemed it important to publish herein a portion of my correspondence (although not written for publication), for the purpose of indicating more fully the progress of our work, and of illustrating in a measure, the difficulties with which we have had to contend.

The publication of the questions and answers contained in some of these letters, will impress more forcibly upon the public mind the fact that ours has been a task without precedent, and amidst novel surroundings, where most undertakings were, necessarily, only experimental. Under such circumstances, it was but natural that mistakes should have been made, and I hope that in pointing out these I have done something useful for future guidance.

I have regarded the issuance of this report as something more than a matter of mere official detail; and I feel that it must be a subject of sincere congratulation to you, as it is to me, that, notwithstanding the difficulties we have had to encounter, and the comparatively short time devoted to overcoming them, it is possible to point to so much that has been done in the preliminary work for the development of that island.

A word of explanation is perhaps necessary with reference to the report of Professor Blake. The paper embodies the results of an exploration of a portion of Yesso made in 1862, and is deserving of a place in the publication not only because of its intrinsic merits, but also from its confirmation, in many particulars, of later observations made under the auspices of the Kaitakushi.

The reports of Messrs. Warfield, Wasson, Lyman, Munroe, Boehmer and Lieut. Day do not require extended references in this place. It is sufficient to say that they are suitable indices of the valuable services which the gentlemen named have rendered to the department. In this connection I desire to express to these gentlemen my obligations, as also to Messrs Holt and Dunn for their earnest and intelligent cooperation in the work we have had in hand, embracing as it has, the first scientific surveys ever undertaken in Japan.

I regret that the completion of the maps which should accompany this report has been unavoidably delayed. They are in the course of preparation, and will be completed at an early date. It is also to be regretted that

the additional geological and mineralogical reports of Messrs. Lyman and Munroe, cannot be immediately published on account of the non-completion of the valuable maps which should accompany them.

Allow me, in conclusion, to tender to yourself, and the officials of the Kaitakushi, my thanks for the many kindnesses shown me during my connection with the Kaitakushi, the recollection of which will be among the most pleasant memories I shall bear from Japan, and will continue to be, I feel assured, a never failing source of pleasure.

I am, my dear Sir,
Very truly yours,
HORACE CAPRON.
Commissioner and Adviser of the Kaitakushi.

ABSTRACT

OF

REPORT

OF

WM. P. BLAKE,

GEOLOGIST AND MINING ENGINEER.

NOVEMBER 20TH,

1871.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1874.

ABSTRACT

OF THE

REPORT OF PROFESSOR BLAKE.

In a preliminary letter to General Capron, dated at Salt-Lake City, Utah, U.S.A., August 15th, 1871, Professor Blake gives a general account of the nature and extent of his explorations in Yesso, and of the results thereof. Together with Mr. Pumpelly, he was engaged by the Japanese government, through its Commercial Agent at San Francisco, C. W. Brooks, Esq., to act as Mining Engineer and Geologist. This proposition emanated from the Cabinet of the Tycoon, the island of Yesso being designated as the field of operations. Professor Blake and Mr. Pumpelly arrived in Yokohama after a passage of ninety days on the sailing ship *Carrington*. Owing to uncertainty as to the nature and scope of their proposed work, the Japanese government having formed no definite plans for their future operations, they remained in Yokohama three months before proceeding to Yesso. At length, it was definitely settled that the aim of their investigations should be the development of the mineral resources of Yesso, especially of those portions belonging to the central government, as distinguished from the domain

of independent princes. Hakodate was made their base of operations, and they were given full discretion as to the method and extent of their work. Several Japanese students accompanied them in their explorations, and in the winter they gave instruction in mining engineering and geology to classes of native students at Hakodate. It was discovered that the government had made some attempts at working mines in Yesso, and was even then conducting lead mining and a sulphur industry upon a considerable scale, efforts having also been made to mine and manufacture iron. It was impossible, however, Professor Blake discovered, to obtain any satisfactory information as to the mineral wealth of the island; and he determined that only actual investigation would enable him to ascertain with what minerals he had to deal, and how Japanese labour could be best utilized for their development according to the most approved modern methods. The summer months were spent in explorations of the mining localities within 125 to 150 miles of Hakodate extending over the greater part of the country lying to the North and West of Volcano Bay. Professor Blake made several expeditions of this character, returning each time to Hakodate and reporting progress to the governor The party travelled upon horseback, and were kindly and hospitably treated at the various Japanese inns where they stopped. They subsisted in great part upon Japanese food, being able to obtain good fish in almost every locality. Salmon and other fine varieties abound in the rivers, and are caught in large numbers by the Ainos. Trout also are plentiful, especially in the upper parts of the river and in their branches; great quantities are caught and dried, forming an important article of export. Among the many marine products utilized by the inhabitants and made articles of commerce, are the coarser varieties of seaweed. The better kinds are found on the western coast, as also a great many other sea-products, such as béche-de-mer,

echini, haliotis and cuttle fish. Game abounds in the interior, deer horns being an important article of export.

The population of Yesso is over-estimated. Hakodate and Matsmai are the principal cities. There are a number of Japanese trading and fishing villages along the coast each way from Hakodate, but as one goes farther north the number of Ainos, or "hairy men" increases. They penetrate the furthest recesses of the mountains in the interior, hunting and fishing, and from them is gained the best knowledge of the interior. They pay tribute in many ways to the Japanese, and are, apparently, very docile and gentle. Physically they are well-formed, muscular and active. Under proper guidance they would, undoubtedly, be of great use as laborers. Their habitation extends even to Sagalin and the Kuril islands, and all names of rivers, mountains &c., north of Volcano Bay are Aino. The interior of Yesso is mountainous and rugged, but covered with a fine growth of deciduous trees, the oak and chestnut, particularly, abounding. A considerable quantity of hard timber is exported, and a remunerative business could, undoubtedly, be established by the erection of saw mills. Some of the mountain slopes, especially those of volcanic origin, are covered with a thick growth of small bamboo, "*take*," almost impenetrable, and a great obstacle to travel as well as to cultivation.

Nearly all the varieties of the whole range of geological formation are represented in the soil and rocks of the island. There are a great many imposing volcanic peaks and groups of extinct volcanoes. The nearest to Hakodate, Komangadake, is especially interesting from the fact that it has been in violent eruption since Commodore Perry's visit. The traces of that eruption were fresh and distinct in 1862. A village had been swept away, and an extensive area of forest had been destroyed by an overflow of hot water accompanied by great volumes of sulphurous steam. The trees, stripped of their limbs and

bark, were still standing in many places, though half buried by a deposit of scoriæ and ashes, chiefly small fragments of pumice. The crater of this volcano is an extensive depression with almost vertical walls. It can be descended, however, and traversed to the inner crater, where fire was (in 1862) still visible, accompanied by jets of steam and vapors of sulphur. Another volcanic cone, Esan, rises as a landmark at the end of the land southeast of Volcano Bay. This is also solfataric, and has very valuable deposits of sulphur. There is a remarkable group of similar cones to the northward of the Bay, which yield large quantities of sulphur of good quality.

Perhaps the most important slope, agriculturally, of Southern Yesso is that extending southward from the mountains toward the peninsula of Hakodate. It faces the straits, has a southern exposure, a rich, deep soil, and a climate which nearly corresponds to that of Philadelphia and Baltimore. It is, in general, free from forest growth and is well adapted to the cultivation of corn, potatoes and the cereals. The broad bottom lands of the Toshibets will, also, afford a superior soil and wide, level terraces, adapted to cultivation upon a large scale and with modern labor-saving appliances. This great valley, however, is comparatively unknown, even to the Japanese themselves. Indeed the whole of Yesso is practically a *terra incognita* to the inhabitants of Nippon. The conditions of life and labor in the former are very different from those in the latter. The people of the southern island are inclined to regard their neighbors of the north as a rude, illiterate and inferior race.

In that portion of Yesso over which Prof. Blake's observations extended, there is a variety of minerals, including coal, iron, lead, copper, gold and sulphur. The most extensive mining operations of the island, so far as he could ascertain, were in lead at Ichinowatari, about two days journey from Hakodate, where the mines and the

works for concentrating and reducing the ores are of an extensive nature.

The sulphur industry is, probably, the next in importance, and gold mining (placer) might be very profitable, if properly developed. Sulphur is principally found at the solfataric cones north of Volcano Bay and at Esan. It is doubtful whether any change for the better in the extraction and refining could be made, unless a much purer product, such as is given by distillation, is required.

The gold deposits are upon the Kunnui river, which empties into Volcano Bay. The gold is found in fine small scales, and is difficult to save by sluicing. Careful exploration might reveal the parent veins higher up the valley. It is to be noted, however, that the chief deposits were worked over two or three centuries ago, and it is difficult to discover to what extent the gold has been removed.

The iron ore is "sand ore," an old beach deposit now uplifted. Several copper localities were visited, but did not seem to be worth working. The best coal was found in a nearly vertical three-foot vein on the west coast at the most distant point north reached. It had not been worked.

THE LEAD MINES AND FURNACES AT ICHINOWATARI.

On the 24th of May, 1862, Professor Blake and Mr. Pumpelly, in company with a Japanese officer, five students and an interpreter, made their first excursion of examination. A journey of two days through the fine farming lands of the valley of the Arigawa to Ono village, and thence up the valley, brought them to the lead mines of Ichinowatari. At this point the valley is very narrow, and the hills rise on either side to a height of 800 feet or more. The vegetation along the way confirms the generalization of Professor Asa Gray, that the flora of Japan is closely allied to that of the northern portion of the United States. Professor Blake and his companions

were met by the officers in charge of the mines, and were conducted to the comfortable quarters which had been prepared for their reception. After resting, they ascended the hills, and, putting on their mining suits, entered the mine through a tunnel running horizontally into the side of the mountain. The timbering of the tunnel was good, being nearly the same as that used under similar circumstances in the mines of America and Europe. The rocks were a compact black limestone and greenstone. The way was lighted by small bamboo torches which burn brightly, but give forth a very disagreeable smoke. The tunnel was not straight nor regular in size, bending to the right and left to avoid hard ground, powder never having been used in the country for blasting purposes. It varied in height from 5 to 4 and even 3 feet, and was the only means of draining the mine. As the grade was as irregular as the height, the drainage was not very perfect. The ore was carried out in baskets upon the backs of men. At the end of the tunnel there are several large chambers whence the ore had been mined. These chambers and the galleries were so irregular that it was difficult to ascertain their number and direction. The vein nowhere appeared to have been over two or three feet wide, and was generally much less than this, a large part of it consisting of the dolomitic vein stone, or pearl spar, generally tinged a beautiful pink by oxide of manganese. From the appearance of the black limestone and the greenstone, it would seem that the vein might properly be classed among those of contact. It will doubtless be permanent, but it can never be very rich. The period of its greatest production was in 1860, when the smelting works just below the entrance of the mine turned out 520 lbs. daily. In May, 1862, the yield was 80 lbs. per diem. For this production the labor of over 60 persons was required. For the three years preceding 1862 the yield was about 66 tons of metal. The miners, when not working on large

bodies of metal, were paid according to the weight and quality of the ore they extracted. For ten *kans* (about 80 lbs.) of best ore they received $\frac{1}{2}$ *tempo* (about $\frac{1}{2}$ cent,) for the same quantity of poorer quality, $\frac{1}{4}$ *tempo*. Working in dead ground, they were paid according to the distance driven: for one *shak* (foot,) of hardest rock, 30 *tempos;* for the same distance in the softest and easiest rock, 7 *tempos*. In the hardest rock one man will drive one *shak* in five days, thus earning 5 *tempos* per day.

At the reduction works the ore is first sorted by hand, then passed under rudely constructed stamps, in close mortars, driven by a water wheel. It is then sieve-jigged by hand, this work being chiefly done by women who are very expert. The cleaned ore is then taken to the furnace room, and is then smelted in a very simple open furnace, consisting of a pot sunk to the level of the earthen floor with a wall on the outer edge opposite to the tuyere by which the blast is delivered. This blast is obtained from a rectangular box in which a piston works horizontally. The ore and the fuel are put in together, iron is added, and the operation commencing at daylight lasts until 9 o'clock in the morning, when the upper crust of slag and cinders is removed. One crust after another is taken out as they cool, until the molten metal at the bottom is reached. This is ladled out and poured into a small ingot mould. The daily expense at this mine, including fuel (charcoal) was about three dollars! It is government property and was worked by the government.

There is one peculiarity of the Japanese method of working mines. They drive two tunnels at the same level, not far apart, connecting them at intervals by cross cuts. This, they aver, is for ventilation, although it can hardly be so, as the tunnels are on the same level and therefore of the same temperature.

GEOLOGY OF THE VICINITY OF ICHINOWATARI.

The first outcrops in the hill in which the mine is, are

of limestone and sandy shales, then greenstone. About half way up is a small dolomitic vein, containing galena, sulphuret of copper, blende and pyrites. Greenstone, also, comes out in heavy ridges. Higher up, the hill is covered with a dense growth of deciduous trees and plants. Ferns, masses and flowers are abundant, and on the moss-grown trunks of the trees are found two species of helix. At the summit there was an outcrop of slate, and in one of the masses was found a fossil plant resembling a calamite, leading to the conjecture that this series of hard uplifted rock belongs to the carboniferous age. Drab colored argillaceous limestone and pyrites abound. The trend of the rock formations of the mountain was N. 25° to 30° W. with an easterly dip.

From Ichinowatari Prof. Blake and party proceeded to the volcano of Komangadaké and thence via Shikabe through a fertile country and at times through a fine growth of forest trees to the

GOLD AND COPPER MINES AT KAKUMI.

These mines were abandoned in 1856, after two drifts or tunnels had been run. Little or no metal was found, although five veins were counted by the Japanese. In all examinations nothing more has been discovered than veins of pyritous quartz, calcspar and iron and copper pyrites.

IRON AT KOBUI.

At Kobui upon Volcano Bay there was a deposit of iron sand, so abundant, that the Japanese had erected a furnace according to European models to work it upon a large scale. This furnace, however, was better adapted to working coarse ore than fine sand. The sand appeared to be very pure and it seemed probable that the ore would be good for making steel. At places similar ore could be dug out of the banks in hard masses, the particles of per-oxide of iron having been consolidated by a sort of cementation.

Coal near Usibets.

After examining the remarkable sulphur deposits at Iwōsan, or rather Iwaonobori, (a solfataric cone of great size,) Prof. Blake proceeded to Iwanai and thence to the coal locality on the west coast. In a narrow valley about $1\frac{1}{4}$ ri ($3\frac{3}{4}$ miles,) from Ushibets the principal seam crops out, appearing to be about 8 feet thick, 3 feet in the middle being good clear coal, while the rest is more or less slaty. The beds are uplifted, dipping west at an angle of 55°, and trending from 8° to 10° east of north. The section, is approximately, as follows :

8. Argillaceous beds.
7. Coarse sandstones.
6. Argillaceous shales and imprints of plants.
5. Coal—a thin seam.
4. Shales and clay.
3. Coal.
2. Siliceous beds.
1. Argillaceous and calcareous beds.

In the ravine beyond the coal outcrop were found outcrops of a siliceous rock, semi-opaline and very thinly and evenly stratified, so that it presented a ribbon like, banded appearance upon the surface. It looks like some specimens of fossilized wood, and internally upon breaking has a dark bituminous appearance. It is brittle and the fracture is conchoidal. It forms a hard bar of rock along parts of the ravine and is four or five feet thick. It was examined for fossil remains, but none were found, although parts of the surface were curiously marked as if by plants and tree branches. In the argillaceous shales above the coal, imprints of equisetaceous plants were discovered, but, with the exception of a few leaves of deciduous trees, these seem to be the only fossils. No work of any consequence had been done upon this coal vein. The coal when ignited gave a bright, cheerful blaze and a long flame ; it was highly bituminous, and produced a light, spongy coke. Prof. Blake was inclined to believe that it was an excellent coal. He so reported to the government,

and urged that the bed should be opened and preparations made to mine it on a large scale. He considered the place to be the most promising of any in the southern part of Yesso for introducing foreign methods and mining appliances. He still regards this coal as perhaps the most available and directly valuable mineral product that came under his notice during the whole course of his explorations. He is also of opinion that a profitable coke industry might be established, or that the coal might find a ready sale for the manufacture of gas. The establishment of a profitable coal mining industry at this point would not, he thinks, be very difficult or expensive. The situation of the coal and the shape of the ground would render the work easy and preclude the necessity of any great outlay.

The Gold Mines of Kunnui.

On the 5th of August, 1862, Prof. Blake proceeded from Hakodate to the gold mimes of Kunnui, via Ono, Washinoki, Yurap, and past the base of the volcano Komangadake. To Ono the road was through the broad, fertile valley of the Arigawa ; thence it rose to the side of the mountain and passing the base of Komangadake, traverses an exceedingly well wooded country.

At Shirarika, just beyond the village of Yurap, there was an outcrop of black, silicious rock, and of a sandstone totally different from it, and beyond a dyke of amygdaloidal rock, lava-like, in which were large agatized silicious masses. Higher up from the mouth of the Kunnui a similar outcrop was discovered, and beyond that nodules of chalcedonic agate, some of them six and eight inches in diameter. From the mouth of the river some distance inland the whole region is covered with luxuriant vegetation, so dense and rank as to resemble the growth of tropical forests. Among the plants noted, were the elm, maple, birch, beech and oak. Wild grape vines were seen loaded with fruit. Here, as elsewhere in

Yesso, one is constantly reminded of the similarity of the flora to that of New England and New York.

The Kunnui gold washings are in the valley of the Toshibets river about seventy miles from Hakodate. The gold found there is a fine-grained scale gold, and the deposits extend along the river and its branches for several miles. There are evidences that this gold was worked two or three centuries ago, by whom it is not known. At the time of Professor Blake's visit, the total expense of working the deposits was about three dollars per diem, and the daily production about fifty dollars. The gold is found in a deposit of coarse-gravel about twenty feet thick, resting upon a bed of argillaceous sandstone. Ditches were cut through the centre of this deposit, and the gravel was washed on either side and then piled in the centre. The novelty of this method consists in the use of a moveable, flexible sluice bed, upon which the auriferous sand and gold is drawn while under water, the sluice bed being so much inclined in a current of water, that all the lighter sand and gravel is swept away. This sluice bed consists of tightly woven straw mats, which are placed side by side, so that the width is equal to the length. The use of quicksilver in mining was unknown in Japan, until Professor Blake's visit, when for the first time its importance and great practical value for saving gold was made known, and its use was commenced at some of the placers at Kunnui. This use of quicksilver gave so much satisfaction to the Japanese, that at the expiration of the engagement of Professor Blake, it was mentioned as one of the valuable results of his visit. The Japanese method of sluicing over moveable mats, although ingenious and successful in a small way, did not compare favorably with the methods perfected by long experience in California and other gold diggings. One principal defect was the difficulty, almost the impossibility, of drawing up the auriferous sand and gravel when submerged without the

gold settling to the bottom and being lost. By constant working over and over the greater part of the gold may be saved, but this requires more labor by far than to dig and sluice the gravel when nearly free from water and then throw it into the sluice boxes or into the "long Tom." Prof. Blake caused to be erected, therefore, at Kunnui several lengths of board sluice box and a "long Tom," and notwithstanding many impediments these were afterwards worked to great advantage.

At Kunnui traces of ancient working have been found at several places. In one place the diggers cut across an old pit, and found an ancient wall of stones, laid up without doubt where the ground was formerly washed. Trees at least 150 years old were growing over this wall. Among the hills there were many other evidences of old workings; pits over-grown with forest trees, maples and birches, many of them over two feet in diameter, and heaps of gravel and heavy boulders betokened the expenditure of a vast amount of labour at some past time. The region had, without doubt, been extensively worked by a large body of men, but by whom and when the Japanese did not know. (It may here be mentioned, that Siebold says in his "Mariner's Guide" that gold was formerly mined in Yesso by the Ainos.) On one hill terrace Prof. Blake discovered an old wall on one side of a ditch which was probably used as a sluice. There were also the remains of an ancient reservoir, with a ditch leading from it, along which appeared to have been distributed the places of washing. There were, also, the traces of an acqueduct of considerable size by which the river water was distributed over the surface.

His examinations were sufficient to convince Prof. Blake that the gold deposits of the Kunnui region were extensive and important, or at least that they had been so at a former time. He concluded that it remained to be ascertained how thoroughly the ground had been worked,

and whether in the very midst of the old pits there might not still be a considerable amount of gold, which could be secured with profit by means of improved methods, and, especially, by the hydraulic process. The abundance of gold in these deposits and the attrition of the particles convinced him that there must be an extensive gold field up the stream, where heavier particles and even gold-bearing quartz would be discovered. The limited time at his disposal, and the many obstacles to exploration, deterred him from making the examination.

Lead Mines at Yurap.

These mines are similar to those at Ichinowatari, and are similarly worked. Prof. Blake visited them September 6th, 1862, when they were looking remarkably well. They had been worked for a long time, from 150 to 200 years, but by whom at that remote date could not be ascertained. There are three main tunnels in these mines, extending to the surface upon the steep slope of the mountain. These, together with an intermediate fourth tunnel, are connected at irregular intervals. The main entrance is by a very narrow, tortuous and contracted gallery. Some of the passages are very difficult; in places, where the rock is hard, the gallery is only about five feet high by three feet wide, all the work having been done by the hammer, wedge and pick.

It was at this lead mine that Prof. Blake first introduced blasting. Practical instructions were given to the miners in the use of powder for this purpose. The improvement was deemed so important that it received special notice and commendation from the government.

Petroleum.

At Yamukushinai upon Volcano Bay there was an exudation of thick mineral oil, tar-like in consistency and appearance. It was not very plentiful, however, and there were no satisfactory indications of its being more abundant at a greater depth. In that locality the oil was used

for medicinal purposes, for burning and for lamp black in the manufacture of ink.

General Observations.

The salient features of the geology of Yesso are volcanic. Volcanic cones tower above the general altitude of the mountains. Prominent among these are Esan, Komangadake, Usu and Shiribets. Some of these volcanicmountaisn are known to have been active within the last twenty or thirty years. They all rest upon a foundation of upraised, stratified rocks, consisting of sandstones, slates and limestones. There is in addition, upon the western coast, a granitic region, forming bold headlands and a rugged mountainous interior. The stratified rocks are believed to be later in age than the carboniferous, although the evidence upon this point is meagre and unsatisfactory. The only well-defined fossils which Professor Blake saw were of the cretaceous and later formations. The uplifted rocks are covered by a heavy deposit of breccia conglomerate and sandy beds. It is a formation of volcanic origin; in some places presenting all the conditions of angular fragments, rounded masses and water-worn particles. It everywhere gives vivid evidence of a period of intense volcanic activity when the greater portion of the present surface was beneath the sea. The formation records the existence of volcanic islets, which by their irruption when partly submerged gave rise to the immense accumulations of volcanic débris around them. We find these volcanic strata at intervals along the whole coast, generally giving bold, rocky cliffs with rough surfaces, and exhibiting irregular stratification. It occurs particularly upon the western coast. It is found also in the interior, covering the upraised sediments at a height of 1,200 to 1,500 feet above the sea.

The enormous amount of volcanic ejections and débris which must have been more or less distributed and assorted by the ocean currents, can be the more readily

conceived when it is considered what took place at the volcano Komangadake since the visit of Commodore Perry to Japan. The whole mountain fell in, and the soil for miles around is formed of fragments of pumice and ashes. As much, or more, perhaps, fell into the sea. At the present time (1862) the beach for miles either way is strewn with pumice and is formed of the volcanic ejections.

But the horizontally uplifted volcanic strata, raised by the gradual and general elevation of the island, are not the only evidences of oscillations of level. There are also horizontal marine sediments, apparently of fluviatile origin, which are now found in the interior and hold a variety of fossil marine mollusks, as for example at Kunnui. We have also terraces along the estuaries and streams, and finally the alluvial deposits and the gently sloping accumulation laid down at the foot of the mountains by the streams flowing from them. It is upon these slopes and alluvial borders that the best agricultural lands will be found.

There is a great variety in the rock formations of the island, giving by their abrasion and decomposition a great variety of soils, and soils holding a wide range of chemical constituents or mineral substances adapted to the wants of plants. The granitic and volcanic formations have soils rich in the alcalies and silicates; the limestones give the calcareous elements, and the sand-stones and argillaceous strata furnish the sandy and clayey alluvia.

As regards the distribution of minerals of economic value, it may be said in general that the highly metamorphosed sedimentary strata yield *gold;* the less altered and sandy beds, interstratified with limestone, yield *lead ores;* another group of strata contain *coal,* and the volcanic cones affords *sulphur.* These, with the *iron sand* of Kobui, are the chief minerals of Yesso, so far as could be ascertained.

Island of Sado.

Of the island of Sado and its vein of rich silver and gold bearing ore, but vague and desultory information could be gained. Samples of the ore are remarkable for their richness, and closely resemble the first class ore of the Comstock vein, Nevada. It seems to be an ore that can be readily worked, but which requires a high degree of metallurgic skill and experience for its proper and most remunerative development. Professor Blake deems it highly probable that there are great quantities of refuse about the mine, which might, by the aid of machinery, be profitably worked over.

Magnetic Iron Ore.

It is an interesting scientific as well as economic fact that magnetic ores of iron occur in the province of Nambu in Nippon, nearly opposite Hakodate. Such ores indicate the presence of the older rocks of the earth's history. This ore has been mined and smelted in Nambu for a long time, and large bloom-like discs of wrought iron are manufactured from it.

Conclusion.

Concluding his report, Prof. Blake alludes to his recommendations made from time to time to the goverment for the advancement of education in the physical sciences and their applications. He endeavored to arouse special interest in the subject, and to make the work he had already done and the teaching apparatus already on hand, such as the library, instruments and chemicals, a nucleus about which to organize a complete institution either at Hakodate or at Yedo. His efforts, though cordially and kindly recognized, were unsuccessful. Owing to anticipated domestic and foreign complications, the government was unable to carry the project into operation, and Prof. Blake and Mr. Pumpelly, at the termination of their year's engagement, sailed from Hakodate to the United States.

REPORT

OF

A. G. WARFIELD,

ENGINEER IN CHIEF

OF

KAITAKUSHI OF HOKAIDO,

TOKEI, JAPAN.

December 29th, 1871.

TOKEI:
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1874.

TOKEI, JAPAN, *December 29th*, 1871.

GENERAL;

In compliance with your instructions dated September 27th 1871, I have the honour to submit the following report, accompanied by a map of that portion of the island of Yesso, examined by me, together with a plot of the city of Sapporo, and a map on a large scale, showing the general topographical features of the surrounding country, with the location of several small villages in the immediate vicinity of the new capital.

The reconnoissance as I understand it, (for my part) was undertaken for the purpose of insuring a careful and minute examination of all that portion of the island of Yesso lying north of Hakodate, and extending as far as the city of Sapporo, as to its general topographical features, and adaptation to the construction of common roads, and other more improved means of communication between the interior and coast towns.

Feeling assured, from the special manner in which you refered to Sapporo and the surrounding country, that you desired a careful examination of the location of the capital, in reference to its proximity to a suitable and available harbour, and the country intervening, and in the immediate vicinity of both places, it was believed essential that the undoubted advantages to be desired from such an

examination, should not be passed lightly over in their preliminary reconnoissance, nor suffered to be neglected for want of adequate information as to its advantages and practicability of access by the most approved means of travel and transportation, &c.

In view of the above reasons, and others that will be given from time to time, the idea of an examination of that portion of the island intervening between Hakodate and Sapporo was abandoned, and in consequence of the decision, I pushed on from Skoni, the place at which I parted with Prof. Antisell, to Sawara, a fishing village on Volcano Bay, and crossed from there in a small sailing boat to Mororan, from which place I continued my journey on horseback, by the most frequented route to the capital

This action was in part determined upon, by the lateness of the season, and the fear that winter rain and snows would close field operations before I could reach Sapporo, in the event of my attempting an examination of that portion of this island intervening between Hakodate and Sapporo; and was deemed still more necessary and important from the fact that the limited time allowed, would not permit an examination to be made in a manner that the very peculiar and difficult nature of the country seemed to require &c. The lateness of Prof. Antisell's arrival at Sapporo, proved the correctness of my views in connection with the subject.

Before proceeding with a description of Sapporo and the surrounding country, I deem it proper to give a brief statement of the main features of the distance traversed between Hakodate and the capital, in order to insure a correct understanding of the objects, details and results of the reconnoissance.

The coast along the straits of Tsugaru from Hakodate to Shuakobe, for a distance of about ten miles has a general easterly direction, unbroken by any cove or inlet, and presenting a continous sandy beach, backed by a series

of clay and rock bluffs and narrow valleys, formed by the foot hills of the mountains of the interior, which as they approach the straits gradually subside into a broad crescent-shaped plain, which extending west from Shukobe half encircles the bay of Hakodate.

This plain is crossed by several water-courses tending to the straits; and its surface, covered with a heavy growth of tall rank grasses, forms as seen from the coast along the straits, a broad and attractive middle land between sea and mountains.

From Shukobe to Cape Esan the country is exceedingly rough and mountainous, with a high and rock-bound coast. The many small streams that have their source in the hills, pass through narrow but fertile valleys, which offer to the inhabitants of the numerous fishing villages along the waters edge, suitable lands for the cultivation of such vegetables as they need for their support, in addition to fish, which forms the chief part of their food.

The southern side of the peninsula is entirely different from the western.

Facing Edomo Bay (marked on the maps "Volcano Bay") the rocks are volcanic, and overhanging the beach in high bluffs, form the abrupt termination of the east and west range of mountains, which is the water-shed or divide of this portion of the peninsula, and is densely-wooded. On the southern side of this divide, and facing the straits of Tsugaru, the hills, though rich in grasses, are barren of trees.

This water-shed is not a direct line of any given course, but is tortuous to the last degree, often nearly overlapping itself, and forming numerous re-entering angles. The heights of the summits are seldom over eighteen hundred or two thousand feet. After passing the volcano of Esan, a very active solfatara lying at the eastern point of the peninsula, and forming the cape of the same name, the precipitous character of the country rendered it impossible to continue by land even on foot.

This section of rough and uninhabitable country does not extend over a coast line distance of more than seven and a half miles—and was passed in a boat worked by sixteen oars and sculls. The boat kept as close as possible to the shore, in its shade indeed. Cliffs hundreds of feet high, of brown, columnar rocks, rise from the water's edge, at whose base resounds the thunder of the waves. After passing around this portion of coast the general character of the country very materially changes, but little improvement however was found in the timber met with, none that was observed being suitable for anything but fire wood.

Between the foot hills of the range are numerous fertile valleys, narrow and bounded by the slopes of the spurs on either side. Streams that take their rise in these valleys are generally well lined with a heavy growth of small timber along their banks.

The peculiarly broken nature of this peninsula, however, it should be stated, presented many serious obstacles to a comprehensive examination of the district passed over.

It is possible that several of the numerous passages that extend their ramifications through these mountains may afford a practicable way for a road.

It is often the case that narrow canons lead up from between the foot-hills of mountains, and finally open out into broad ravines which penetrate the mountains to a considerable distance and afford the means of passing roads from one side to the other of the range. These remarks refer to the possibility of Hakodate being connected by road with some villages on the southern shore of Edomo Bay, as for instance, Sawara, by way of the valley of Ono.

As I was unable to make an examination of that portion of the peninsula lying between Hakodate and Sawara, nothing definite can be said in connection with it, further than that it is reported to be a good and easy route for

the construction of a first class common road, which is very much needed between the two places for the accommodation of the existing trade and travel which is very considerable during the summer and fall.

In refering to the Harbour of Mororan, in a general way, the mind naturally embraces the entire expanse of water, of which Edomo Bay, contitutes, technically speaking, the major part. Edomo Bay needs no special description in this report further than will be given in connection with the harbour of Mororan, which is situated at the north-east part of the bay, and commands a greater number of miles of coast-line than any other harbour in the island. As rapidly as the tonnage and draught of vessels have increased in a few years, rising from ten or fifteen hundred to five or six thousand tons, it is hardly probable they will ever exceed the capacity of this harbour, which at low water would admit vessels of twenty-five feet draught.

It is accessible at all seasons of the year, sufficiently commodious, and entirely land-locked and safe.

Although the region in the immediate vicinity of the harbour is generally rough and hilly, yet it is well watered, and covered with a dense growth of timber. The land along the small streams is good and yields fair returns to labour. The quality of the land improves as you advance to the west along the shore of Edomo Bay, and an extensive valley exists on the Sarubets river, which enters the bay about twenty-five miles from the harbour, and is one of the best tracts of land in this region.

The special commercial importance of the harbour of Mororan in connection with the future growth and development of the new capital, and all that now but partially settled district of country around the shores of Edomo Bay, and along the Pacific coast as far north-east as Cape Eramo, is beyond a doubt.

The general course of the route from the harbour of

Mororan to Sapporo will be seen by reference to the accompanying map.

After leaving the harbour of Mororan, it follows along the Pacific coast as far north-east as the mouth of the Yubuts river, and from thence, turning inland, takes a general westerly direction to Sapporo.

The general topographical feature of that portion of the route from the head of the harbour of Mororan to the mouth of the Yubuts river are those of a narrow plain, running parallel with the coast and varying in width from one to three miles, crossed by a spur of the coast range of mountains that extend as far as the valley of the Yubuts. The plain has an average elevation of about thirty feet above the sea, and is well watered by several small streams and rivers tending to the ocean.

None of these rivers, it would appear, run directly from the mountains towards the sea; but in every instance, so far as known, from the south-west to north-east, forming oblique valleys, much longer and with a more gradual descent than would otherwise have been the case.

Most of them bring down considerable bodies of water throughout the entire year, and all, as may be supposed, swell greatly during heavy rains, or the melting of the snow in the mountains. Their course is rapid, and none of them can be considered as navigable, even for short distances, as they all have deltas of low land at their mouths, and generally several channels.

Salmon are caught in the largest of these rivers, and I was informed by the native Ainos that fine pine timber was to be had on their banks some eight or ten miles back from the sea.

The greater portion of that part of the route between the harbor of Mororan and Yubuts river is a desirable region for settlement.

The soil is often sandy, but it is fertile, and there are many agreeable and promising locations for farming,

where a good soil plenty of good wood sufficiently near for lumber or fuel, pure cool water, an agreeable and healthy summer climate, and a pleasing prospect, are inducements not often found united, and are sufficiently attractive to throng these mountain valleys at no distant day with a population of vast importance. The country between Yubuts and Sapporo is covered with a heavy growth of most excellent timber. The divide, better known as the great plain of Yesso, which separates the waters of the Yubuts river from those of the beautiful Ishcari, is very low; not over five miles intervene between the head waters of the Bubu and Chitose, the former a tributary of the Yubuts which empties its waters into the Pacific ocean on the east, and the latter a tributary of the Ishcari which flows into the Japan sea on the west.

This whole dividing ridge, then, separating the waters of the Yubuts from those of the Ishcari river, is not the lofty range of mountains which might be supposed to separate the sources of two such great bodies of water, flowing in opposite directions and to outlets so widely distant, but is a gently undulating and exceedingly well wooded and watered section of country.

The most remarkable feature of this region, especially the western slopes and level plains of the divide, is the abundant growth of various kinds of trees nearly all of which are suited for building purposes. Undulating and level plains, skirted by woods of various growth, and clothed every where with rich verdure; numerous and rapid streams, with innumerable small but limpid lakes, frequented by multitudes of wild-fowl most conspicuous among which appears the stately swan, these, in ever recurring successions, make up the panorama of this extensive plain, and which may be said in a general way to be everywhere fertile, beautiful and inviting.

There is not to be found on the island an unoccupied field, for the establishment and permanent support of a

large city, such as should form the capital of Yesso, equal to that of the beautiful Ishcari valley ; and no location commanding a greater extent of arable land, with the same advantages of access to both the western and eastern coast of the island, could have been selected for the city of Sapporo.

Situated as it is upon the very banks of the Toyohira river a tributary of the Ishcari, and at a point where its water-power is unsurpassed by that of any other river in the island, manufactories will naturally develope with the growth of the city.

The day is not far distant when the manufactories which will grow up along the banks of the Toyohira river, and around the new capital, will engender a commerce far exceeding that arising from the fisheries ; and as the mighty forest recedes under the insatiable demands of an increasing population, agricultural products will fill the apparent void, for it is certain that the soil where these vast forests now grow is remarkably prolific. And if at some period in the future when numerous flourishing towns and villages shall have sprung up with the growth of Sapporo, the timber should be exhausted, in this now densely wooded section of the valley, a bountiful providence has stored up in other parts of the island, for the use of coming generations, an abundant supply of coal, an article which is the basis of most of the wealth of Great Britain, and which, more than any single product of the mines, has enabled the United States to take her present stand among the nations of the earth.

Viewed as a whole, the valley of Ishcari is undoubtedly one of the most interesting and inviting portions of the island, and the location of Sapporo, with its unequalled water-power, and the proximity of that power to the city —together with its comparatively central position between the Japan Sea and Pacific Ocean, in the Great Plain that extends from coast to coast, and lying as it does but little

north of the forty-second parallel of latitude, in the Temperate Zone, with a climate most favourable to physical strength and intellectual activity, it must eventually become the great commercial and manufacturing centre of the island. If we examine a map of the world we will be struck by the fact that the line of the forty-second parallel is central to a vast region of the most productive agricultural land of the temperate zone; that north of Sapporo there is a vast area which, in similar latitudes in Europe, America and in Asia, is inhabited, and found to be so productive that at this very moment it is increasing in population and wealth.

Besides these advantages, it can be connected by canal, with the Isheari river, which is twelve miles distant at the nearest point, and is the only river on the island of which any considerable use can be made for purposes of navigation.

From its head-waters the Ishcari river flows in a general south-westerly direction, and enters the Japan Sea about fifteen miles, north-west of the Bay of Otarunai, and is navigable as far as I ascended, more than fifty or sixty miles above its mouth for all vessels that can pass the bar, at its entrance, during the different stages of high and low water in the river. I was informed that there were from seven and a half to eight feet of water over the bar, during the summer and fall months; and that for a short time in the spring, immediately following the freshets, there were from twelve to fourteen feet, the latter, however, is the case for but a short time, and depends upon, and varies with the amount of rainfall each season.

The tide does not rise more than eighteen inches at the mouth of the river.

The river is about half a mile wide at its mouth and narrows down to seven hundred feet at the mouth of the Shinoro, a small tributary that empties into it about ten

miles from the sea—the latter width is retained as far as I ascended.

The banks of the river are on an average from ten to twenty feet high, and all along on both sides is to be found the finest ash timber on the island. In fact I do not think that there exists any where in Japan such an abundant supply of this truly valuable timber.

This immense quantity of fine ash can be cut, and floated down the river, in the form of large rafts, to a good site for a saw mill, say in the neighborhood of the Shinoro, when it can be sawed and shipped to all parts of the empire. The river is closed by ice to navigation from the middle of December until some time in April.

It overflows its banks during the spring floods ; which is also the case with the Shinoro, Toyohira, and Chitose which empty into it from the north east. One good effect resulting from the peculiar formation of the valley is, that it tends to give the river a sinuous course, which diminishes its velocity.

As in the case of the Mississippi, so in this, if the river were straight the velocity would be too great for the purposes of navigation.

Some of the characteristics which I have not mentioned of this portion of the valley of the Ishcari are, that the tributaries have generally much clearer water than the river itself, and are from the deposits that there take place narrower at their mouths than elsewhere; that, in many instances, the bottoms may be said to be swamp-land, being occupied by numerous marshes, lakes, ponds, and sloughs, which diminish the value of the exceedingly rich land ; that the banks of the rivers are heavily wooded, there having been observed by myself but few localities, which could be called barren plains.

Besides these characteristics, I will mention that the Ainos reported that large coal measures had been discovered near the head waters of the Ishcari, and the pro-

babilities are that good building-stone and possibly lime-stone may be found to exist in the same locality. If such should turn out to be the case, upon examination next spring, it will be of very great importance, owing to the fact that no really good quarry has yet been found near the city of Sapporo.

The Bay of Otarunai is situated about thirty miles west of Sapporo by land and about forty by water. The entrance to the bay is from the northeast ; and is so wide that but little protection is offered to vessels lying at anchor, unless they are under the lee of the head-land which forms the northern shore of the bay. Although the bay is small, yet the depth of water is sufficient to allow the largest class of vessels to enter, and as the anchorage is undoubtedly good, they can weather out a heavy storm.

It is a much better summer, than winter harbour, owing chiefly to the fact, that the north-west winds prevail along the western coast of the island, from about the middle of November until the latter part of March or the first of April, rendering it dangerous for either sailing vessels or steamers during that time. The cold character of the climate throughout the entire winter, is one of its unfavourable features ; and for national considerations its proximity to the dominions of a powerful foreign sovereignty must be a serious objection to it in a military point of view.

In view of the great danger and delay attending navigation through the Straits of Tsugaru, and along the western coast to Otarunai, it is hardly possible that a constant and reliable communication could be kept up under the most favourable circumstances during the entire year, or at least during the fall and winter months.

It is evident in view of the reasons given above, that the winter trade of Sapporo viâ Otarunai would be too limited, and that no government inducements could augment it to that extent, which would justify the expenditure of the large outlay that would be necessary to construct a rail-

road between the two places, owing to the unfavourable nature of the country, through which it would have to be carried.

The settlements on the island are as yet, with the exception of a few scattered villages in the interior, confined to the coast, and occupied by fishermen.

The principal trade, so far, has been in sea-weed, fish and fur, which abound along the coast.

The salmon, cod, herring, and other kinds of small fish, together with sea-weed, are abundant, and the island will probably derive a considerable importance and revenue from this source alone. Facilities for the accommodation of this trade will be found at the Bay of Otarunai on the west, and at the harbor of Mororan on the east, in the event the latter becomes connected with Sapporo by a first class road; where the vessels needed for the fishing can be built, equipped, and found, complete, with every necessary appliance, and manned ready for work. To enable the city of Sapporo to derive the greatest benefit from the undoubted advantages of its commanding position, it should be connected by common roads or other more improved means of communication, with the Bay of Otaruni on the west, and the harbor of Mororan on the east, thereby bringing it into the closest possible connection in point of time, with the settlements and industries along the coast lines.

This is a matter that should receive the immediate and serious attention of the Government authorities connected with the development of Yesso, and is one, that is more closely allied, than any other, with whatever success may attend their efforts; for it is certain that without the proper means and facilities of communication, disaster would follow any attempt to settle the island.

Roads have in all times been among the most influential agencies of settlements and progress; roads are literally the pathways not only of industry, but of social and na-

tional intercourse. Wherever a line of communication between men is formed, it renders commerce practicable; and where commerce penetrates, it invariably creates a civilization and leaves a history. Roads place the city and the town in connection with the village and the farm, open up markets for field produce, and provide outlets for manufactures. They enable the natural resources of a country to be developed, facilitate travelling and intercourse, break down local jealousies, and in all ways tend to bind together society and bring out fully that healthy spirit of industry which is the life and soul of every great nation. The road is so necessary an instrument of development and progress, that in every new colony it is one of the first things thought of. First roads, then manufactures and schools. The new country, as well as the old can only be effectually "opened up," as the common phrase is, by roads, and until these are made it is virtually closed against improvement. Hence roads, canals and railroads, by providing the greatest possible facilities for locomotion and information, are essential for the improvement of all classes, of the richest as well as the poorest. By bringing the ends of a country together, they reduce the prices of commodities to that extent as to render them accessible to all. Without their assistance the concentrated populations of large cities and towns could neither be clothed nor fed; but by their instrumentality an immense range or section of county is brought, as it were, to their very doors, and the sustenance and employment of large masses of people become comparatively easy. In the raw materials for food, for manufacturing and for domestic purposes, the cost of transport necessarily forms a considerable item; and it is clear that the more this cost can be reduced by facilities of communication, the cheaper do these articles become, the more they are multiplied, and so enter into the consumption of the community at large. Imagine for

an instant, what would be the effect of closing the roads, canals, and rivers of Nippon. The country would be brought to a dead-lock, employment would be restricted in all directions, and a large proportion of the inhabitants concentrated in the large cities and towns would perish of hunger. I have dwelt longer than I anticipated upon the importance of improved means of communication, such as common roads, canals, and railroads, but the bearing of the subject upon the future settlement and development of Yezo is such that it could not be satisfactorily disposed of in a few words.

Comparison of the distances on several routes from Tokio to Sapporo.

From Tokio the distances are :

Viâ Bay of Otarunai and Ishcari River.....780 miles.
do. Hakodate, Sawara and the harbor of Mororan680 do.
do. Harbor of Mororan.....635 do.

The above table gives a difference of 145 miles in favor of the Mororan route over that viâ the Bay of Otarunai and the Ishcari river, and 45 miles over the one via Hakodate, Sawara and the Harbor of Mororan. It is not believed that any route will be found which will come into competition with that of the Harbor of Mororan. The only one open now, at all seasons of the year, is that viâ Hakodate, Sawara and the Harbor of Mororan, which takes, under the most favorable circumstances, not less than eight days during the summer months, and in the winter owing to the great delays caused by the weather and snow, it is frequently extended to twelve or fourteen days. The entire distance travelled by land over this route, is done on horseback, thereby exposing the traveller to all the vicissitudes of the climate. It is evident from what has already been said in connection with the Bay of Otarunai, that it can never be to the city of Sapporo more than a summer port ; and in view of that fact, it is

only necessary that such means of communication be established as will meet the requirements of a summer trade.

This can be best, most cheaply, and quickly done, by constructing in the first place, a good wagon or stage road between Sapporo and some points on the Ishcari river near the mouth of the Shinoro,—which should be immediately followed by the location and construction of a canal between the same points, and of sufficient dimensions in every respect, to allow the free passage of canal boats or barges of suitable construction and size, to be towed between the mouth of the canal and the Bay of Otarunai, and used in that way for the transportation of freight, &c. This system will necessitate the purchase of a small steamer, drawing when loaded, not over five or six feet of water, to be used in connection with other duties, to tow these canal boats or barges as may be required, between the mouth of the canal and Otarunai, and it would be well to have the steamer so constructed as to accommodate a small passenger travel that will naturally spring up between Sapporo and Otarunai, with such facilities of communication at hand as this system will afford. In calling your attention to the Shinoro river, up which large sampans now ascend as far as the town of Shinoro, I would advise that steps be taken during the early part of the coming summer to improve its navigation so that it can be made available, until the completion of the common road and canal above referred to, in connection with the Bay of Otarunai.

I think it would be well to connect Sapporo with Otarunai viâ Zenibako by a good common road, so as to have a safe and reliable means of communication during the winter.

It may be well to state, that the road from Sapporo to the Ishcari, can, if found necessary, be continued along the river banks to the town of Ishcari, near its mouth.

Nature has clearly indicated the Mororan route for the

commerce and travel between Tokio and Sapporo, and in predicting its future importance, it is presumed that a line of steamers will be established between Tokio and the harbour of Mororan, and that the latter place will be connected with Sapporo by a railroad.

In order to open a communication as rapidly as possible, by the Mororan route, and as preliminary to the construction of a railroad, when the trade of Sapporo will justify it, a good wagon or stage road, with substantial bridges across the streams, should be opened throughout the entire length of the route. Allowing two years for reconnoissance, location, and making the necessary arrangements, such as establishing the line of steamers, erecting temporary depot buildings for supplies at the harbours of Mororan and Sapporo, and making the contracts, and actually getting the laborers established in the line of the road, I am of opinion, that in about two years after vigorously commencing operations, a first-class road of the three feet and six inches gauge, can be completed and opened for traffic.

The wagon road already adverted to as indispensable along the whole line, should be gradually converted into a first-class stage road, and with the aid of stage-coaches moving at the rate of nine miles an hour (perfectly practicable with good roads, relays of horses every ten miles, and the supplies of forage which the country along the route can furnish), a thorough communication can be established by which passengers can reach the city of Sapporo in twelve hours, from the time they leave the harbour of Mororan. In view of the fact that this is the only route by which a reliable communication can kept up with Sapporo during the entire year, I strongly recommend that steps be taken to commence the construction of the wagon road during the coming summer. A question of great importance in connection with the proposed wagon or stage road, is the effect which it will have in securing for this portion of the island a considerable trade with Sapporo.

The general absence of good building stone along the line of the proposed road is amply replaced by good timber, suitable for all purposes of construction, and which can be used temporarily for the bridges and culverts until replaced by stone.

The streets of Sapporo run nearly due north and south, and east and west, and have the best direction that the almost level nature of the ground will admit of for drainage.

Before any steps are taken to improve the streets, by using the gravel that exists in such large quantities just back of the city, along the bed of the Toyohira river, I would advise that the thing be properly prepared by leveling and grading them in such a manner as to ensure the free passage of water along the drains into the main channels intended to convey the same out of the city limits.

I also advise that the streets be laid off with pavements on each side, as is the custom in all American cities—and have under consideration a plan that, I believe, when matured, will be well suited to the climate and location of Sapporo. The bridges over the canal that passes through the city, as well as the streets, should be constructed with the view to the introduction of wagons and carts as the chief means of local transportation, &c.

The upper portion of the canal should be extended in a direct line with the lower to the Comocomo kawa, and the whole length through the city made about twenty-five feet wide and at least one foot deeper. The accompanying plot of the city shows the number and position of every house that had been built up to the time of my departure, and also gives the locality of the public square, set aside for the department buildings, &c.

A good bridge over the Toyohira, just back of the city, is very much needed. Of all the agencies known to civilized man, running water is the cheapest and most

effective motor, when it is unfailing in its supply, as is preeminently the case with that of the Toyohira. There are two fine sites for factories or mills near the city of Sapporo. The one at the mouth of the canal that empties into the Fuzuo Sapporo Kawa is distant about one mile, north of the city, and has a fall of not less than 15 feet, with a volume of water equal to any demand that may be made for improvements of any kind, &c., and the other is near the mouth of the Showjin kawa and is two and a half miles south of the city, has a fall of about 12 feet, which can be increased I think to 15 feet. The supply of water is not quite so certain or large as that at the first one.

The general direction and relative position of the water courses of the valley, which are so peculiar, will, I think be much better understood by a study of the accompanying maps than by a written description of them.

It is greatly to be hoped that future examinations will reveal good building and limestone in the locality of Sapporo; nothing is more needed for improvements than these articles.

This report contains, in brief, the information obtained during an exploration which occupied about two months of contant travel on horseback, during which time, owing to the remarkable facilities offered through the aid of all the Japanese officers, with me, I was enabled to visit many points that I could not have seen under ordinary circumstances.

It has been impossible for me in the short space and time allowed for the preliminary report to consider thoroughly, and properly discuss in every detail, the merits of the several improvements and routes proposed for the commerce and travel with Sapporo, by common roads, canal, and railroads: enough, however, is known to enable me to offer an approximate estimate of the cost

of the several improvements recommended, in case you should desire it hereafter.

I desire to acknowledge the courtesies and facilities constantly extended to me by the Japanese officers who accompanied me through Yesso.

Respectfully

A. G. WARFIELD,
Engineer &c., &c.

Tokei, 5th Jan. 1872.
To GENL. HORACE CAPRON,
Chief of Commission, &c.

ABSTRACT

OF

FIRST ANNUAL REPORT,

OF

HORACE CAPRON,

COMMISSIONER AND ADVISER

OF

KAITAKUSHI OF HOKAIDO,

TOKIO, JAPAN,

FOR

1871.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1874.

YEDO, January 2nd, 1872.

His Excellency

KURODA DICAN,

Kaitakushi of Hokaido.

SIR :—In accordance with the terms of my engagement, I now have the honor to submit a preliminary report with reference to the opening and settlement of the island of Yesso.

Heretofore meteorological observations in Yesso have been so limited, that all estimates of its agricultural capabilities have been mere conjectures, based upon private reports and comparisons with the climates of other countries. We may now, however, take a more intelligent view of this important subject, as the necessary knowledge of the matter is supplied so far as the limited time for obtaining such information allows.

It certainly will not answer to judge the climate of Yesso by comparison with similar parallels of latitude on the European Continent. I perceive, however, a marked similarity to the climate of the same parallels in the interior of the American Continent. The oak, the beech, the ash, in short all the trees of the forests of New York, Pennsylvania and Ohio, even including the sugar maple, grow in abundance and to perfection in Yesso. In Yesso on the same parallel these trees thrive even on the high

mountain slopes, while in America at the same altitudes they are gnarled and stunted.

The isothermal line passing through the Raleigh, N.C. crosses the island of Nippon near Yedo (lat. 35° 20′), where the temperature and rainfall are about the same as at Raleigh. The line touching the city of New York (lat. 41° 30′), is found in the island of Yezo near Hakodate at latitude 41° 46′. The mean annual temperature of the latter place has been for five years 47° 47′, while at New Haven Connecticut (41° 20′) the mean temperature for the same period was 49°. Continuing these interesting comparisons, I append the following:

MEAN TEMPERATURE FOR FIVE YEARS.

	Latitude.	*Spring.*	*Summer.*	*Autumn.*	*Winter.*
Hakodate	41°46′	46°43′	64°	59°	29° 4′
Cambridge, Mass.	42°	44°57′	70°	51° 7′	23° 9′
Penn Yan, N.Y...	42°40′	42°27′	66°20′	49°98′	23°50′

Mean temperature in Hakodate for 5 years... 47° 47′

„ „ „ Cambridge „ 5 „ ... 49°

„ „ „ Penn Yan „ 5 „ ... 45° 46′

The highest and lowest temperature in the state of New York in 1870 between latitudes 41° and 43° 31′ was:

January, highest ..... 68°; lowest— 14°.

February, „ ..... 46°; „ — 25°.

and in Wisconsin (between latitudes 42° 30′ and 45°) in the same year:

January, highest ..... 46°; lowest— 25°.

February, „ ..... 54°; „ — 29°.

At Hakodate during the same year the highest temperature was 84°, and the lowest 42°.

The mean temperature during June, July and August for five years, at the places above named was as follows:

	June.	*July.*	*August.*
Hakodate	58° 66′	64° 66′	68° 79′
Cambridge	66°	71° 10′	70°
Penn Yan	64° 53′	66° 70′	67° 22′

The rainfall in the United States for twelve months is 38.05 inches, and in Hakodate is 36.92 inches. These statements are collected from the reports of the members of the commission and from the meterological reports of the Smithsonian Institution, and in no case show any marked difference in either temperature or rainfall between Yesso and the richest and most populous States of the Union. The great fall of snow in Yesso (which is included in the rainfall), is a great advantage, serving, as it does, to protect grains and grasses from the frost and to prevent the freezing of the ground to any depth. Carefully weighing these facts and considering my own experience in the more northern American States, I am forced to the conclusion that the obstacles to a profitable and permanent development of the resources of the island of Yesso lie neither in the soil nor in the climate.

Mineral Wealth of Yesso.

It is apparent from the accompanying reports that neither judgment nor skill have in the past characterized the opening and working of mines in Yesso, and, undoubtedly, all suggestions for their future management, however practicable, will fail, if undertaken in the same manner. The coal, silver and sulphur of the island are, without doubt, of great value, and whether worked by the government or by individuals, will, if care and skill are exercised, prove an ever-increasing source of wealth. Of other minerals this cannot be so confidently predicted, although it must be borne in mind that only about one fourth of the supposed mineral region has as yet been examined.

The coal mine of Kajemona will richly repay any amount of judicious expenditure under competent and trustworthy supervision. This mine should be reopened, and it is of the first importance, as at the silver mines of Ono Valley, that the landing and means for loading vessels immediately from the mines, which mismanage-

ment has heretofore rendered useless, should be improved and perfected. The sulphur mines at Esan require more scientific and intelligent methods, not only in securing the crude article of commerce, but also in the manufacture of sulphuric acid and gun-powder.

I have already said that the mines of Yesso will richly repay systematic and economical management, whether public or private. It has been the experience in England and America, however, that such enterprises are never productive of so satisfactory results under government auspices as when left to individual effort. A system of royalties paid to the government by individuals or corporations for the privilege of working the mines would seem to be the best means for securing the highest productiveness. Such a system presumes, of course, the enactment and enforcement of the necessary laws for the regulation of mining interests and rights of property, and would, perhaps, be best enforced under the supervision of competent officers in a bureau of mines. But if it is decided to work the mines at the expense of the government, I can at any time have prepared the necessary plans and estimates.

Sapporo.

Without renewing the criticisms in the accompanying reports upon the location of this town, and in the absence of any recommendation of a better site, we may presume that it is to be the capital of Yesso, and may proceed to suggest methods for its improvement.

The valley of the Ishicari river contains a large space of fertile soil, and, if properly cultivated, could sustain a large population. The river, affording great depth of water for many leagues into the interior, has its source in a region of presumably great mineral wealth. With suitable improvements at its mouth, large vessels could at all times enter and find a safe and commodious harbor,

or pass far up the stream. Numerous small tributaries furnish inexhaustible water power for manufacturing and other purposes. Excellent navigation, a fine water power and a good supply of timber are thus to be found in the neighborhood of the future capital of Yesso, leaving no material means of development and improvement to be desired, except, perhaps, good building stone and lime, which thus far have not been discovered in the immediate vicinity of Sapporo.

The reports herewith contain many suggestions for opening communication to and from the capital. The first in importance seems to be the construction of a good wagon road from Sapporo to the Ishcari at the mouth of the Shinoro, a distance of about 12 miles, which must continue to be the route of approach until the more important road to Mororan shall have been built. This latter will be about a hundred miles in length and will pass over a country offering no obstacle to the construction of a good macdamized road, or railroad, when the time comes for such an enterprise. The harbor of Mororan, the prospective port of entry for Sapporo, is always open and clear of ice, is well protected and has depth of water sufficient to float the largest vessels. With the exception of Hakodate it is, undoubtedly, the best harbor in the Empire. In the absence of a suitable harbor on the west coast, and in view of the fact that the Ishcari is closed during five months of the year, it is evident that the construction of a road between Sapporo and Mororan is of great importance. I therefore recommend that the proper steps be immediately taken, so that in the Spring a complete survey for both a rail and wagon road may be made and the wagon road immediately constructed. I would also recommend the construction of a canal from the Ishcari to Sapporo, a distance of twelve miles, to enable vessels to pass from the river to the town. I consider this a work of great importance.

Government Farm.

The establishment of the Government farm at Nanai near Hakodate was, probably, judicious at the time, but convenience and economy would seem to require its location at Sapporo, where in future all the operations of the Kaitakushi should be concentrated. I recommend that this farm be limited to a scale suitable to the requirements of a school of experimental and practical agriculture, sufficient in extent, however, for an advantageous exhibition of improved methods in the use of machinery and fertilizers and the rearing and training of stock, etc.

It is desirable that the different mechanical pursuits such as the business of the wheelwright, blacksmith, carpenter, etc. should be established at Sapporo. Grain and saw mills should also be erected. These enterprises might more properly, perhaps, be left to individual effort, but it seems indispensable that the government should take the initiative.

Fruits.

I approach this important subject confident in the belief that not only Yesso, but the whole Empire of Japan, is capable of becoming a fine fruit country. A fertile soil and a climate ranging through the entire range of the temperate and semitropical zones, would seem to insure the successful cultivation of the best fruits. The apple, the most prized of all fruits, flourishes in cold and mild regions, and will find a congenial home both in Yesso and Nippon, as will, perhaps, the peach and nearly all the smaller fruits, while the grape can undoubtedly be grown with success on the volcanic mountain slopes of Nippon. Failure may occur in some instances, but many varieties of fruit must, without doubt, be successfully introduced, to which will be added other varieties developed by grafting and new modes of culture, and in the end the Government will be richly repaid for any expense it may incur in this direction.

SETTLEMENT OF YESSO, &c.

Having solely in view the best interests of this Government which has honorably received and kindly treated me, and wishing to avoid any useless or doubtful experiments, I have made the foregoing comparisons as to the climate of Yesso which seemed the only doubtful question touching its agricultural development. I submit the accompanying reports, maps, charts, &c., bearing upon this point, to your careful consideration. As far as my remarks have any reference to future operations, they presuppose careful and economical expenditure of the funds appropriated for the development of the resources of Yesso, and that such funds will not be diverted to any side issues or to the support a large supernumerary force which will rather retard than advance the main purposes of the enterprise. They are made irrespective of any financial considerations, for which I must not be held responsible.

Our investigations thus far have opened to us a wide and attractive field. The resources of Yesso seem to be all that the most ardent friend of our enterprise could desire. The island contains 35,739 square miles; its mountainous surface is interspersed with fertile valleys and covered with the most valuable timber. There are many streams of pure water, some navigable and others affording fine water power. Salmon, cod, herring and sardine are found in these streams, and in the adjacent seas, while the island abounds in choice varieties of fur bearing animals. The fibre productions, hemp, silk, &c., will be a fertile source of wealth. The island's great mineral resources give promise of rich returns. The harbors can at small expense be made safe and commodious. The climate, without being unexceptionably fine, is as healthy and invigorating as that of the Northern American States, and offers no impediment to successful agriculture.

With such conditions and resources, the settlement of Yesso were an easy matter, had we to deal with the hardy

people who settled America. If thrown open to settlement on the liberal terms offered by the government of the United States in similar cases every available acre would be at once occupied. Exclusive settlement by native citizens gives another aspect. A people reared in the mild climate of Nippon cannot be expected to readily adapt themselves to the more rigorous climate of Yesso. They must become gradually inured to it, and must learn that it is not only possible to live comfortably in a cold climate, but that the invigorating influences of such a climate, together with a partial change of food, will strengthen the system and enable it to resist the influences of the cold.

Whatever course the Government may adopt as to the settlement and occupancy of Yesso, the survey of the island for convenience of location and description is an indispensable prerequisite. This survey should commence in the valley of the Ishcari, and should be extended as necessity requires, including the survey of town and city sites, and a separate examination of mineral lands.

I append a synopsis of the laws of the United States regulating the disposition of such lands, which may prove of use as a reference.

There are three principal laws and many supplementary acts. The first of the three acts is the

HOMESTEAD LAW.

By this law the settler is enabled to become the *bona fide* owner of a tract of 160 acres of the public domain without cost, except the payment of $10 to the land officer of the district. Conditions are attached: the settler must move upon the land within six months, and reside thereon continuously for five years; he must build a comfortable house and make sundry other improvements; at the end of the two years he must prove that he has complied with the conditions of the law, when he will be entitled to receive from the Government a patent or deed for his land.

The second law is the act of

PREEMPTION,

which gives the settler who has fulfilled all the conditions of the foregoing law, but who has failed to record at the land office his intention of taking the land, the right to obtain clear title to the same by paying the Government the established price per acre $1.25 for minimum land and for double minimum land $2.50.

The third law simply defines the mode of sale for cash at public auction.

CHANGE OF FOOD PRODUCTIONS.

The ultimate necessity for a change in the food productions of Japan will scarcely admit of doubt. Rice, the great staple, is not only the most expensive, but it is also the least nutritive of the food grains.

The cost of production in the case of wheat for the same amount of nutritive elements is twenty-five per cent less than with rice. It is the cheap production of bread food, together with the great variety of fruits and vegetables that enables the American people to enjoy many of the luxuries of life, and leaves many of them free to swell by other pursuits than the production of food the aggregate wealth and commerce of the nation.

It cannot be expected that the soil of Nippon, worked for centuries under the same system of cultivation and without rotation of crops, will be found favorable to all forms of vegetation. Analysis and experiment, however, must determine this, and the difficulty, when ascertained, must be remedied by change in cultivation, the introduction of renovating crops and the application of animal and mineral manures. Such remedy is merely a question of time and of intelligent observation of causes and effects and judicious application of the teachings of experience. The soil itself, particularly in the valleys, is naturally one of the richest in the world.

Acclimation of Immigrants, Method of Inducing Immigration, &c.

The changes necessary in the habits and food of the emigrant from the milder climate of Nippon to Yesso must necessarily be slow. In no way, it seems to me, could it be better facilitated than by the introduction of a certain foreign population accustomed to the more rigorous climates of Europe and America, who can teach the native immigrant by example, the methods of best meeting and overcoming the difficulties of his new situation.

I do not deem forced immigration either advisable or politic, if practicable. To obtain a population loyal and friendly to the Government, change of residence should be a voluntary act on the part of the immigrant. Drawn by their individual interests, having a title to the soil they occupy, and liable at any time to be called upon to defend that soil, such a people, come whence they may, will be an enduring strength to the nation, and will serve as a bulwark against the encroachments of any foreign power.

Depot and Nursery in Yedo.

I deem the establishment of a depot and nursery in this city, in connection with the contemplated improvements in Yesso, judicious and proper. The great distance from which the stock, plants, &c. must be brought, the time consumed in such transmission and the changes of climate through which they must pass, render it necessary that there should be an intermediate point for rest, examination and partial acclimation. The influence which such a place may have upon the introduction of these new varieties of animals, vegetables, fruits, &c. into the island of Nippon is also of great importance.

Agricultural Colleges.

It should be the endeavor of this Government to establish by every possible effort, scientific, systematic and practical agriculture. In no way can this be done more effectively or economically than by connecting with the

gardens at this place and also with the farm at Sapporo, institutions at which shall be taught all the important branches of agricultural science. These institutions should have well appointed laboratcries, and should be supplied with professors of acknowledged ability in their several specialities. A Professor of Entomology would, for example, be of incalculable service to the farmers of this country where the insects annually destroy millions of dollars worth of property.

Machinery and Labor.

The rapid social and political changes now in progress in Japan must necessarily involve a revolution in the whole labor system of the Empire, in fact in its whole politico-economical creed, and in nothing more than in the appliances for agricultural and mechanical pursuits. At present the enhancement in value of human labor by the introduction of machinery may not seem important, but it would not be creditable to the great minds who so quietly yet surely direct this movement, to suppose that they do not expect or desire that it shall elevate and increase the value of human labor. If it be true that the wealth of a country is in proportion to its aggregate labor, over and above what is necessary to support its people, to what other source than, the introduction of machinery, can this nation look for an increase of its wealth? So long as human muscle continues the cheapest of all power, and competes successfully with the dray-horse on the streets, there can be no permanent advancement. The time must soon come when in the progress of trade, commerce, manufactures, and all the varied arts and industries, a higher civilization will require that in Japan, as in other civilized nations, manual labor shall be supplemented by all known forms of mechanical science and ingenuity. It is eminently proper, therefore, that the work of this Department should be recognized as having not merely a local but a national significance.

To avoid prolixity I have passed over many points which will require our future attention, and have but cursorily touched upon those which demand immediate notice, considering it important to dwell mainly upon those subjects which will constitute the year's work. There are many things in the accompanying reports well worth attention, to which reference may be made as we proceed.

I would respectfully recommend that the surveys undertaken at the very end of last season, be pushed with vigor during the coming season from the first opening of spring, so that the whole of the hitherto unexplored portions of the island may be included.

I have the honor to be,

Sir,

Very respectfully,

Your obedient servant,

HORACE CAPRON.

APPENDIX

Showing estimated cost of construction of certain roads, canals, buildings, &c., and the amount of other necessary expenses.

Wagon road from Sapporo to Ishcari river.....	$ 20,000
Canal „ „ „ „ „	150,000
Improvement of present canal	2,500
Buildings and other expenses for the settlement of Sapporo	150,000
Wagon road to Otaru.....	15,000
Geographical, geological and other surveys.....	25,000
Re-opening, improving and working coal, silver and sulphur mines.....	160,000
	$522,500
For model farm at Sapporo, including buildings, additional stock, &c.....	25,000
For improvement of grounds at Yedo, including erection of buildings, &c.....	65,000

The foregoing amounts should be expended during the present year as a basis for future operations.

Cost of construction of a wagon road between Sapporo and Mororan is also hereby noted, as is the cost of a railroad between the same points :

Wagon-road . .....$	200,000
Railroad.....	4,000,000

The construction of a railroad is not recommended at present. The probable expense for educational purposes and for office and other contingencies I am not able to estimate further than for college buildings, which are included in the above estimate.

VARIOUS LETTERS

ADDRESSED DURING THE YEARS

1872 AND 1873,

TO THE

KAITAKUSHI DEPARTMENT,

BY

HORACE CAPRON,

COMMISSIONER AND ADVISER

TOKEI:

PUBLISHED BY THE KAITAKUSHI.

1874.

CORRESPONDENCE.

DURING THE YEARS 1872-73.

EXTRACT FROM A LETTER ADDRESSED TO GOVERNOR KURODA DATED AT HAKODATE, JULY 8TH, 1872.

"In the absence of any proper instructions from the Kaitakushi in relation to their plan of operations, except in a very general way, I am left in ignorance of many designs for expenditures unless as I may chance to blunder upon them. I cannot be expected at all times to give the most correct advice as it appears to me that my engagement with this government contemplated, and therefore I must not be held responsible for anything beyond that upon which I am consulted.

There are some schemes with which I seem—more accidentally than otherwise—occasionally to be made acquainted, and upon which I feel called upon, in the faithful performance of my obligation with this government, to express my views, as failing to do so might be construed into an acquiescence on my part.

Of this character is the proposed improvement of the navigation of the Ono river. Of course, I had no oppor-

tunity to examine the project critically, but my familiarity with the subject enables me to speak with confidence adversely to an expenditure of that kind, not only as *useless but impracticable.* Without a survey I could not say that it is entirely impracticable, but such is my full belief. I think I may safely say, that a railroad sufficient for the wants of the valley may be constructed with far less money than would be required to open that river for any useful commerce, and would be far more available and convenient. Beyond that, it appears to me the great wagon road now being constructed will be ample for the present wants of that section of country, and there are many much more important objects which require the immediate attention of the Kaitakushi in carrying forward their great work."

Very respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser of Kaitakushi.

SAPPORO, YESSO, *July* 22, 1872.

HIS EXCELLENCY

KURODA DIKAN,

YEDO,

DEAR SIR,

I arrived here on Saturday, the 20th inst. Through the kind attentions of Mr. Enomoto and Mr. Yugee, the trip was rendered very pleasurable. I have made full notes upon the way, with reference to the climate, soil and general resources of the Island, as they presented themselves to me, which in this hastily written communication I cannot refer to, except in a very general way.

* * * * * *

The resources and climate of this island have been misunderstood, or misrepresented, at least to me. My own conclusions, however, more particularly with reference to climate, as given in former communications, have been fully sustained by personal observation. If the natural products of a soil are any indication of its fertility or climate, this Island will compare favorably in these respects with some of the wealthiest and most populous portions of the United States.

Maizé, which is as good a test crop as any I know, was planted here during the past spring, at my suggestion, and now gives promise of a fair yield.

So far the climate as is indicated by the present high range of the thermometer and the dryness of the atmosphere is exactly the reverse of what it has been represented to me. The present season may be an exception, but there are no indications either in the indigenous or the exotic vegetation that this belongs to the "sub-frigid-zone." I repeat the opinion expressed in my former reports, that the climate is no obstacle to the successful occupation and development of Yesso.

* * * * *

I have now to speak of some very essential mattters in connection with the growth and improvement of this place (Sapporo.) The first is the proper and more judicious development of its water power, and this is intimately connected with the necessary irrigation of this dry plain and the supply of a sufficient amount of clear water for the wants of the city itself, both of which objects may be attained at the same time. A careful inspection has convinced me of the feasibility of the work. The canal at present in process of construction will not allow of the use of more than half of the fall, the remainder being lost between the point where the canal leaves the river and the mill site, in a rapid descent through the whole distance of more than a mile, by which at least one-half of the power is

lost. If this water were conducted from the main stream on a higher level, with no more fall than absolutely necessary for mill-purposes (say one foot per mile), all the water required for irrigation and for a full supply in every street of the city would be at command, and the available power would be trebled. I would most earnestly call your attention to these important suggestions before further expenditures are made in this direction.

The preparation of the soil for supplying food for the large population concentrating here, demands more consideration than, I fear, is now given it. It is presumable that it is not the intention to depend upon Nippon for a supply of food. If that is the intention, the enterprise will surely fail; space should, therefore, be provided and other preparations made for the necessary cultivation of crops in the spring. I am sorry to learn from the Governor that he has no money at hand for this purpose.

There are still other subjects to which I should like to call your attention, and of which I have already spoken to the Governor here. But I can now only refer to them in a general way. They will require some action on the part of the Government for their successful accomplishment.

The improvement of the breeds of horses, cattle and swine in this island, is a matter of the highest importance. Such an improvement can never be accomplished, however, with the present custom of allowing all the male animals to run at large. This difficulty can only be obviated by the issuance of an edict, commanding that all the native stallions, bulls and boars be either altered—i.e. deprived of the power of generation—or removed to some remote part of the island, and by the introduction of foreign animals in their stead for breeding purposes.

* * * * * *

There is great wealth in the timber of Yesso: much of

it is of the finest quality and will command a market in any country in the world. I am pleased that my suggestion for the getting of a large quantity of timber at the mills has been carried out; it can now be prepared for immediate use here, or for shipment, as may be desired. An opportunity will, also, be offered to test the value of the machinery introduced, than which, I believe, there is no better, for its intended uses, in the world.

* * * * * *

ABSTRACT OF LETTER DATED

SAPPORO, YESSO, *July 15th*, 1873.

His Excellency

KURODA KIYOTAKE DIKAN,

DEAR SIR,

I forwarded to you from Hakodate, several letters, the result of my observations at Nainai &c. I have now to report my arrival at this place with health somewhat improved.

On my way up I passed over the entire length of the road lately constructed from Hakodate to this point, which is now completed and ready for carriages with the exception of the bridge across the Toyohira river at Sapporo. I am gratified to be able to state, that I am well pleased with the location and construction of this thoroughfare throughout. It is a grand work, and will do more for the development and settlement of this Island than all that has been done besides. Already its beneficial effects are seen in the new farms and settlements all along the route from Hakodate to Mori, which will be continued on the other side of the Bay now that portion of the road is open to travel.

The same influences are visible on all the new roads of lesser magnitude, as for instance, to Otarunai and Shinoro

—all along which roads are continuous settlements of small farmers, which give great promise, and this only within a year's time.

My impressions are now the same as when I made my first report in January 1872, as to the port of Mororan. It should be made an open port, and the point at which vessels laden for the eastern coast and Sapporo should discharge their cargoes. Passengers by this route could then reach Sapporo from Tokio in five days or less, which is a much shorter time than it takes now from Hakodate to this place, and will save the crossing of Volcano Bay which is always disagreeable, often dangerous and sometimes impossible for days.

What Hakodate would lose by this, would be made up to her in the increased development and cultivation all along the new road to the bay and the surrounding country which is already making itself felt, and by a further extension of that road along the coast to Oshamumbe thence across the Island to the western coast at or near Yochi, a very desirable and practicable route.

The new town of Mororan would soon become an important place, and its influence felt throughout that portion of the Island as it now is on the other side of the bay from the improvements there.

The transportation of all light articles and passengers from Tokio would enable them to reach Sapporo in less time than it now takes from Hakodate. That is; passengers leaving Tokio may reach Sapporo by this route in from four to five days, whereas it now takes *nine days* by way of Hakodate, and often by detentions at the crossing of Volcano Bay ten or twelve days.

A good line of suitable light carriages drawn by good Japanese ponies (not the great lumbering omnibuses and Shanghai horses) would easily take over passengers in two days from Mororan to Sapporo, resting over night

half way—or in twenty four hours, if necessary, and thus may be conveyed all light articles of freight.

The progress made in the construction of buildings, &c. here is a great improvement on the paper houses of last year, and far more suitable for the climate; but I am sorry to say, that their appearance is being ruined and the effect upon the place destroyed by the dirty green colour they are painting them.

Since my arrival here I have reviewed Mr. Lyman's and Mr. Wasson's labors. They are both progressing in their individual spheres satisfactorily. Mr. Lyman's report of his examination of the coal regions of Iwanai and the shipping facilities along the coast has determined me to accompany him on a further and more thorough inspection of them. Mr. Lyman is now on the Ishcari river making a complete survey of the coal reported as existing there, and the facilities for getting it to market by water communication. On his return here, it is proposed by the Governor that we shall cross the Ishcari river, visiting various points of interest there, thence to the town of Ishcari and along the coast line via Otarunai to Iwanai, &c., and back to this place to meet him on his return from the north.

Mr. Wasson has made an excursion up the Ishcari river, over a hundred miles at the instance of the Governor and also with the view to establishing the base line for his trigonometrical survey in that region, and also to report upon the agricultural, timber and other resources of that hitherto, but partially explored region. His letter is encouraging and will be referred to more fully in my subsequent report. Since Mr. Wasson's return he has established his base line near Yubuts, and now awaits the receipt of his instruments, daily expected from America.

I have availed myself of Mr. Wasson's leisure from his legitimate work to have a line of levels run from this to the Ishcari river via Shinoro, in order to determine the

fall and the number of locks which will be required, and other general obstacles to the construction of a canal, in order that I may be better prepared to make an intelligent report upon the subject as directed in your communication of the 15th May last. In addition to this duty I have suggested to him another route, the results of my previous inspection of the country in that region lately made.

I left here on the 5th inst. in pursuance of your instructions, to inspect the channel of the Toyohira river from this to its debouchure with the Ishcari, having in view the improvement of its channel for navigable purposes. I coursed this river the entire distance in a canoe, making soundings at various points and taking notes of the various obstructions. The channel is rather tortuous, with various depths of water, and in many places a rapid current. The shallowest sounding was from one and a-half to two feet on the rapids at this stage of the water, which I was told was low. The other impediments were principally drift wood, fallen trees, &c., which in some places nearly closed the stream.

Upon the whole I think it would pay to remove these barriers, first, in order to open it to navigation for a certain class of flat-bottomed boats drawing not over two feet of water, and secondly to prevent the overflow in times of freshets. This latter is of much importance, as a large tract of country otherwise useless may be reclaimed.

In the United States such streams are utilized by the application of steam power in small "stern-wheeled boats," drawing very little water, these boats cost but little and are capable not only of carrying considerable freight, but at the same time take up in tow numerous flat-bottomed boats laden with freight, and drawing not over one and a half or two feet of water.

In the absence of steam power, these flat-bottomed boats would require to be warped up the stream or propelled

by poles, but they will be carried down the stream by the current, laden with lumber or other commodities, simply requiring to be guided. I should think that one hundred men in one month's time, properly directed, would relieve the channel sufficiently to enable boats to pass without trouble.

In looking for the most feasible route for a canal from this to the Ishcari, I extended my trip up the Hatsuba Kawa, a small stream entering into the Ishcari a short distance below the Shinoro. I ascended this stream as far as practicable with our canoe. I found it for several miles above its mouth carrying a considerable depth of water with but a slight current, and from the general topography of the country am of the opinion that it drains in part, that very considerable tract of swampy land which extends to within a short distance of Sapporo. Should this be the case it will undoubtedly form the most desirable route for a canal, accomplishing two very important objects, the drainage of the now worthless tract of country, and at the same time furnishing cheap water communication for Sapporo. I have therefore directed Mr. Wasson to continue his surveys over this route.

With great respect,

Yours most truly,

HORACE CAPRON,
Commissioner and Adviser
Kaitakushi of Hokaido.

No. 5.

SAPPORO, *July* 18*th*, 1873.

His Excellency
KURODA KIYOTAKE DIKAN,
KAITAKUSHI.

DEAR SIR,

Believing that you will be interested in Mr. Lyman's progress in the Coal regions of the Ishcari, I herewith send you a transcription from letters lately received from him.

After speaking of the inclemency of the weather and other obstacles to his progress, having to cut his way through driftwood in many places, he says in his letter of the 12th instant:—

"I have only taken a hasty look at the coal exposures "here, but find them looking very well, some half dozen "workable beds in good position for working and the "quality good. Two beds or more, are perhaps five feet "or more thick. The extent seems very great, as bits of "coal are found in many neighbouring streams for miles "away; but the place is outside of all creation. It is "twelve or more miles (5 ri) from the Ishcari or any "navigable waters, and twenty-seven miles (11 ri) in a "straight line west-north-west from Sapporo."

Under date of 13th instant he writes:—"The coal "seems to run towards Sapporo or perhaps further east "toward some point on the new road a dozen miles from "Sapporo, but I doubt whether it will seem worth while "to survey so far in that direction unless some clear "traces of coal should be found here and there towards "the new road, if so, it would not be so very far from the "east coast, say about Yubuts or some place further south."

The distance is of course too great from the Ishcari or any other navigable waters for a railroad at present (the small stream on which it is situated cannot be made navigable.) It is quite possible that it may lead towards the eastern coast, so far as to make it easily approachable by railroad from the harbour of Mororan at some future period, and perhaps further surveys may trace it to some navigable stream running east.

Very respectfully,

Yours, &c.,

HORACE CAPRON,

Commissioner and Adviser
Kaitakushi.

P.S.—A letter just received from Mr. Lyman says, (dated July 22nd, 1873)

"The coal here continues to look very promising, at "least four or five workable beds I should think up to "six feet thick."

"Although I have now the material for a pretty com- "plete section of the whole series, I cannot put it on "paper at once. The same beds are exposed repeatedly, "and as they have been very badly opened, and the ex- "posures so numerous, it has taken longer to measure "them besides the surveys than I expected," &c., &c.

"It will require some eight or ten days of good wea- "ther to get to Sapporo, but the importance of the coal "here, as well as the delays in making a journey to it "again, seems to justify this length of time."

As soon as Mr. Lyman arrives here, we shall start together for the west and along the coast to Iwanai.

Very respectfully

Yours,

HORACE CAPRON,

Commissioner and Adviser,

Kaitakushi of Hokkaido.

No. 7 *Copy.*

SAPPORO, *July 25th,* 1873.

His Excellency,

KURODA KIYOTAKE DIKAN.

DEAR SIR,

I have the honor to report that since my arrival here I have visited the numerous agricultural settlements in this portion of the Island. In all these settlements I find the most satisfactory progress.

The number of permanent settlers has been much increased since last year, and their farms are in general well tilled, and the crops looking well, giving promise of an abundant harvest, setting at rest the much mooted question

of the natural fertility of the soil, and the generally favorable character of the climate. It is the most encouraging evidence for the future settlement of this Island that I have met with since I came up.

It is this class of settlers that are the most needed here, industrious frugal farmers, who feel that they have an interest in the soil they occupy, and in whatever tends to the general benefit of the Island, and the enlargement of its permanent population.

The most of the crops now raised upon these farms are those common to Japan. What is needed is a greater variety. In this Island isolated as it is, where rice cannot be profitably grown, other crops must be resorted to that can be. This Island, rich in all the elements of production, should export bread food instead of importing it as is now the case. To accomplish this most desirable object, field grains, garden vegetables and fruits should be introduced, and the farmer encouraged in every possible way to turn his attention to their cultivation. This can only be done through the Kaitakushi, by the importation of Foreign seed and plants to be distributed to these farmers on the most liberal terms. It would be good policy to furnish them to the farmers in small quantities for the first year or two free of charge to encourage their introduction.

The cultivation of improved grasses should also be attended to for the raising of farm stock—horses, cattle, sheep, hogs &c., a present to each of these farmers of a few fruit trees from the nurseries at Tokio would have an encouraging effect, and would be attended with much prospective good in their general introduction through the Island. Let them once see the fruits and you need give yourself no further trouble than simply to place them within their reach at a reasonable price, as you are now prepared to do from the nurseries at Yedo.

The introduction of labor saving machinery, tools &c.,

can only be very gradually brought about. It is useless to put them into the hands of the Japanese without instructing them as to their uses and the way to use them, and this should be done by men skilled in the working of these various tools. The importance of this I have had ample evidence of both here and at Tokio, having been compelled to take hold of the plough—in fact every kind of farm implement with my own hands to prevent their being condemned as useless. Once seeing them operate, and understanding the actual advantages of such machines, the ingenious Japanese mechanic at once sets himself to work to manufacture them, as was the case at the farms at Tokio, and I have been amazed at their success in producing machines and tools as good in every respect as the imported sample, and this done without the aid of machinery, in their rude way of working. This is a double benefit to the country; it not only augments the farmers' muscles, but opens a new field of labor for the mechanic.

It will be necessary to have erected at Nanai, before cold weather sets in, a temporary shed or structure of some kind in which to stock the fruit trees which must be brought up from Tokio, this fall, for planting out on the ground at Nanai and Sapporô the next spring. A space about sixty or seventy feet long and thirty feet wide will answer. The roof, north side and ends of this building can be closed in with straw in the Aino style. The south side should have openings that can be closed or left open at will. The ground floor of this building should be well covered over with straw to prevent its freezing before the plants are set in.

There is so much difference in the climate of the two places as to make this necessary; as in the spring the plants are too far advanced in the gardens at Yedo before it is free of frost up here, and in the fall the ground is here frozen before they can be safely taken up at Yedo; there-

fore we must remove them in December, or late in November, and stock them away in this building ready to be set out whenever the ground is in condition.

With great respect,
I am yours,
HORACE CAPRON,
Commissioner and Adviser,
Kaitakushi.

No. 9

SAPPORO, August 6th, 1873.

His Excellency.
KURODA KIYOTAKA DIKAN,

DEAR SIR,—I have the honor at this time, to enclose to you, copies of three letters addressed to Vice Governor Tanaka, marked and dates as follows.

Letter *A* dated July 29th, 1873.
„ *B* „ July 30th, „
„ *C* „ Aug. 1st, „
„ *D* „ Aug. 2nd, „

Very Respectfully
Yours,
HORACE CAPRON,
Commissioner and Adviser,
Kaitakushi.

A.

SAPPORO, July 29th, 1873.

Mr. TANAKA,
Vice-Governor, Acting.

DEAR SIR,—The amount of lumber cut and delivered at the mill-yard is very large, and the amount lying scattered along the banks of the Toyohira river is also very

great, amounting in the aggregate to several millions of feet.

This immense amount of lumber was not cut by my advice, my first suggestion was for a million feet, and the next year another million, making two millions. There has been sawed by steam and by hand, probably one million feet of plank, and there are undoubtedly several millions unsawed.

This has cost much money and demands immediate attention for its preservation, and also some means should be devised to utilize it.

The first thing requiring attention is the large amount of timber lying exposed along the banks of the Toyohira river. It is scattered along up and down, and a very considerable amount is in a very exposed situation just below the new-head gates. These gates would be no protection whatever in one of these heavy freshets which we see the evidence of as having occurred not many years back. I would recommend that all this lumber should at once be floated down the canal and secured.

The next question is as to the best course to be pursued to turn it to some account. To leave it in its present shape, it will crack and decay and soon be seriously reduced in value. If sawed into suitable dimensions for building purposes, well stacked up and secured from the weather, it will increase in value every day, and the buildings erected from it after it is well seasoned will be worth double the money of those now being built.

The two saw mills you now have, can easily saw ten thousand feet of plank every day, if anything like system and industry is given to the working of them. At this rate there would soon be a large hole made in this pile of timber.

In naming ten thousand feet as a reasonable day's work for these two mills, I know exactly what they are capable of doing, and I have placed the amount at least one quar-

ter below what they are required to do in the United States; there are no mills better prepared for work than these.

Working these mills at these rates, at which they can easily be run, you will reduce the cost of sawing below the average of what it has already been done over one half.

To illustrate this, we will take the figures as given me within the last few days of the sawing done by the steam-mill since it was started on the 13th of August last year.

The amount of lumber sawed from the 13th of August to 31st December, 1872, a period of four months, was 17,590 cuts of 13 feet, or, reduced to board measure, was 228,670 feet. The expense for the time was 1,115.62 *yens* or $4\frac{87\frac{1}{2}}{100}$ *yens* per thousand feet. During this time it must be borne in mind they were subjected to great delays in starting the new machinery, as also in teaching the raw assistants.

The amount sawed from 1st January to 26th July, 1873, nearly seven months was but 22,138 cuts of 13 feet, or reduced to board measure=287,797 feet. The expenses for this time were 1,758 *yens*, equal to six *yens* ten cents ($6\frac{10}{100}$) per thousand feet, an increase in the cost of sawing over the previous period of $1\frac{2\frac{2}{3}}{100}$ *yens* for each thousand feet, entirely due to the falling off in the quantity sawed per day.

The importance of running a mill up to its capacity when you do pretend to run it, is still more apparent in the work for the month of June. The amount sawed was but 2,027 cuts of 13 feet or 26,357 feet board measure. The expenses for the month were three hundred and twenty-nine $\frac{25}{100}$ Yen ($329\frac{25}{100}$ equal to $12\frac{49}{100}$ Yens for every thousand feet sawed.) By these statements you will perceive that the expense for sawing is regulated by the amount of work done. The expenses run on whether the mill does or not, costing just as much to saw one thousand feet as it does ten in a given space of time.

The comparative cost for sawing timber by steam or by coolie power is shown also by the statements furnished.

The price paid a coolie for sawing 1 cut of 13 feet soft pine is	Cents	14.48
The price paid a coolie for sawing 1 cut of 13 feet hard wood	„	18.05
Reduced to board measure, it is for sawing 1,000 feet soft pine.....	Yen	11.14
Reduced to board measure, it is for sawing 1,000 feet hard wood.....	„	14.25
Average cost for the two kinds of wood...	„	12.68
It was shown above that the steam sawing cost for 1,000 feet.....	„	4.87
Difference in favour of the steam sawing on each thousand feet.....	„	7.81

Taking the number of feet sawed by the steam-saw since it started last August, namely, 516,467 feet, the actual saving by the steam saw was 4,036.40 Yen, which is more than the first cost of the mill. Had the mill been run, as they are run in the United States—and can be here—the cost for sawing reduced to two Yen per thousand feet—the actual saving would have been 5,511.58 Yen.

I have thought proper to lay before you these facts, having no other motive than for the best interests of the Kaitakushi, and the satisfaction to myself of having done my duty.

Very Respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser, Kaitakushi.

B.

SAPPORO, July 30th, 1873.

MR. TANAKA,

Vice-Governor, (Acting)

DEAR SIR,—My attention has been frequently called by the foreign employés of this Department to certain bills for supplies, subsistence &c., the payment for which

has been exacted from them by the officers of the Kaitakushi here, and great complaints are made at the exorbitance of these charges, amounting in many cases to from one to two hundred per cent above the market prices for the same at Yokohama.

On the 28th inst., a similar bill was presented to me (which I paid under protest) a copy of which I herewith send you. The prices therein charged, as you will perceive, are rather curious—to say nothing of the propriety or impropriety of making any charge under the circumstances—reaching far above any of the most famous Hotels either in Europe or America, and when the difference in the fare and accommodations are considered in the absence of any explanation, it wears a very unfavorable look for a Department of a great Government.

It is not to be presumed for a moment that this Department has not reasons for such demands, which, were they made by an individual, would subject him to severe penalties under the laws ; and it is, that I may know the reasons and be prepared to explain these charges that I would most respectfully ask your attention to them.

Very Respectfully, Yours,

HORACE CAPRON,

Commissioner and Adviser, Kaitakushi.

C.

SAPPORO, August 1st, 1873.

MR. TANAKA,

Vice-Governor of Sapporo.

DEAR SIR,—The statement furnished me by the officers of the Kaitakushi, of the cost and charges for cutting and delivering timber to the saw mill (which of course does not include any charges for the timber itself as that is the property of the Kaitakushi), is so very extraordinary and

beyond all bounds of reason or calculation, that I despair of making any analysis of the items which go to swell up these immense figures. This matter has been entirely under the control of the Japanese, and I could not expect to understand any explanation they could give me. I shall therefore content myself by stating what I know to be the expenses for similar work in a country where they do more at this business than all the rest of the world together, and are therefore supposed to understand it.

The expenses as shown by these statements are as follows:—

For one hundred kokus of pine wood..... 75 Yens.
For one hundred kokus of hard wood.....115 Yens.

Each one hundred kokus after being sawed produces 7,000 feet of boards.

The cost then is for each one thousand feet of boards of pine wood..... 10.71 Yens.
And for each one thousand feet of boards of hard wood.....16.42 Yens.

for the simple cutting and floating these logs down the Toyohira river and canal to the mill.

Contracts are daily made by the owners of saw mills in the United States with the proprietors of lands in the wooded districts, to deliver their logs to the mills at a cost of five dollars per thousand feet of lumber—plank measure. This sum covers not only all charges for cutting and delivering the timber to the mill but the value of the timber itself.

With the facilities they have at this place, through the Toyohira river and canal and reservoirs constructed for the very purpose, it should never have cost over four (4) yen per thousand feet, and I fully believe it can be done for much less money, and then it would be more than double what it costs to do the same work in the United States where the cost of labor is so much higher.

I leave this matter without further comment for your consideration.

Very Respectfully,

Yours,

HORACE CAPRON,
Commissioner and Adviser,
Kaitakushi.

P.S.—It is proper for me to remark, that in the United States the timber is never squared in the woods, but delivered as it is cut down, which is a much cheaper way.

H. CAPRON,
Commissioner and Adviser.

D.

SAPPORO, August 2nd, 1873.

Mr. TANAKA,
Acting Vice-Governor.

DEAR SIR,—I desire now to call your attention to another important subject, the data for which was also included in the timber estimate referred to in my previous letters, and that is *transportation.*

Here again the same difficulties arise as in the other statements, only to a greater extent. This matter of transportation being also in the hands of the Japanese, I must confine myself to the statements before me furnished by the officers of the Department, and compare these charges for transportation with the cost for the same service performed in other countries.

From the statements referred to, it appears that the Kaitakushi charge for the transportation of one hundred kokus, or seven thousand feet of lumber as follows.

From Sapporo to Otarunai
by land or water 20 miles—60 . Yens for 100 kokus.
,, Otarunai to Hakodate by sea.... 185 ,, 55.70 ,, ,,
,, Hakodate to Yokohama by sea 500 ,, 74.30 ,, ,,

Total charges from Sapporo to Yokohama..... 190.00 Yens for 100 kokus.

At these rates the charges would be for one thousand feet of plank as follows.

From Sapporo to Otarunai 20 miles 8.57 Yens
,, Otarunai to Hakodate 185 ,, 7.86½ ,,
,, Hakodate to Tokio 500 ,, 11.61½ ,,

Total cost from Sapporo to Tokio 27.15 Yen for 1000 feet.

The charges on the railways leading out of Chicago, U. S., the greatest lumber market in the world are, for the transportation of one thousand feet of lumber one hundred miles are 1.60 yens. At this rate the transportation for one thousand feet of lumber from Satspero to Tokio should be 8.17 yens, instead of 27.15 yens, as charged by the Kaitakushi.

Railway transportation is always more expensive than by water. From Green Bay by water (the point from which Chicago receives her largest supply of lumber) a distance of about three hundred miles from Chicago, the charges are two dollars and fifty cents per thousand feet. This includes loading and unloading.

At this rate the water carriage from Otarunai to Tokio would be

For one thousand feet of lumber ... ... 5.87 yens.
„ one hundred koku of lumber ... ... 41.09 „

Leaving out of the calculation the carriage from Satspero to Otaroni. The charges from Otarunai to Tokio by the Kaitakushi schedule for one hundred kokus is (130) one hundred and thirty yens.

The difference therefore by the two rates of charge is, is, on every one hundred kokus of lumber eighty-eight 91 yens (88.91); a distance of about seven hundred and five miles.

I think that under such conditions it will hardly be worth my time to consider further the investigation of the question of shipping lumber or anything else from this Island.

It is upon this matter of transportation hinges, more than upon any any other one thing, the advancement of the population and settlement of this Island.

It does not require much foresight to see what the results will be, with expenses for living at this place more than doubled, by these enormous charges upon all the common necessaries of life, at the same time and by the same causes a complete embargo is laid upon all shipments of the valuable products of the Island.

Very respectfully,
Yours,

HORACE CAPRON,
Commissioner & Adviser,
Kaitakushi.

HAKODATE, YESSO, September 3rd, 1873.

His Excellency,

KURODA KIYOTAKA DIKAN.

DEAR SIR,—That I have not hitherto referred more particularly to the mines and mining interests of this Island in my frequent communications to you, is for the reason that I have had no sufficient and reliable data upon which to form a correct judgment. The very superficial investigations of the mineral resources of this Island up to the present year have been entirely too meagre to justify me in recommending heavy expenditures for the working any of the different mines yet discovered. The

folly of acting upon mere surface indications, based upon reports of incompetent judges, who run over the country picking up a lump of coal here and gleaning a thimble ful- of gold there, has been pretty thoroughly tested in prel vious years, and at least advises caution.

That we did not make greater progress the last year in the scientific explorations on this Island is well known to yourself; and the causes; they need not be repeated here. It was certainly no fault of mine. The work for the present year is progressing under the most favorable circumstances, the gentlemen in charge are of the highest distinction in their professions, already they have developed some very valuable and reliable discoveries, which when their full reports are received, accompanied by the sectional maps and charts showing the location of the different mines, their extent and workable condition will form a correct basis for future operations.

Enough has already been furnished in Mr. Lyman's preliminary reports of the two principal coal deposits discovered to justify some suggestions.

The coal field at Iwanai does not show so great an amount of coal as I have been led to suppose, not over one and a half million tons above water level, which although quite considerable, does not appear to justify any very large outlay for the construction of harbour protection for *large ships* at that point. There is in fact no harbour near there, Otarunai being the nearest and that only approachable by sea. There are a few slight indentations in the Coast near by—mere "holes in the wall," which might be so guarded by break-waters as to form protection for a few steam tugs and lighters necessary for loading the ships, which must anchor off the coast and be ready to slip their cables and run off on the appearance of a storm.

The immense deposit of coal lately surveyed by Mr. Lyman near the Ishcari river promises important results,

he has already developed six workable mines with strata of from three to six feet thick, most favorably situated for working and drainage without artificial appliances; he estimates they will produce ten million tons of good quality.

There are two ways by which this coal can be transported to market—one by the construction of a rail road from the mines to the Ishcari river, a distance of about 14 miles, thence down the Ishcari and across the Gulf of Strogonof to the harbour of Otarunai, a distance altogether of about seventy miles—or by railway communication direct to the harbour of Mororan, a distance of about eighty-five or ninety miles. These mines are situated some 20 miles or more from the most feasible route for a railway from Sapporo to that harbor.

By the first of these routes it requires the coal to be handled over several times in the various transhipments, each time adding to the cost and causing a great loss and deterioration in the market value, and it must be borne in mind also that the harbour is only open for navigation about one half the year.

By the way of New Mororan in the harbour of Endermo—which is one of the best on this Island and accessible the year round—the coal can be taken directly from the mines by rail, without any intermediate handling and deposited into the hold of the largest ship, at a cost of about two dollars per ton.

The larger portion of the mines in the United States are from two to three hundred miles at least from the coast, and all are connected therewith by Railways.

This great body of coal, situated as it is in the centre of a rich valley, covered with the most valuable timber only awaiting cheap transportation to a market to be turned to profitable account, together with the importance to Sapporo of railway connection with that harbour, would seem to justify us in looking forward with confidence to the

completion of this road—not perhaps immediately but at no distant future. I do not doubt but that, with proper protection and reasonable privileges guaranteed, capitalists can readily be found who will construct this road.

The results of investigations in the gold and other mineral fields now being conducted under Mr. Lyman, have not been reported with sufficient minuteness to justify any remarks at present. At the close of the season there will be valuable information which will be duly laid before you.

Very respectfully,
Yours
HORACE CAPRON,
Commissioner and Adviser,
Kaitakushi.

No. 11.

HAKODATE, September 6th, 1873.

His Excellency,
KURODA KIYOTAKA DIKAN,

DEAR SIR,—In conformity with your instructions of the 18th of May and the further suggestions of Governor Matsmota, I left Sapporo on the 18th August, accompanied by Mr, Lyman on a visit to that portion of the Sapporo district lying north of the Ishcari river, thence along the western coast south to the Coal mines at Iwanai and to this place when I arrived on the 31st last month.

I visited "en route" the farm settlements along the banks of the Ishcari river. The first in the list called Banyue is on the left bank, and contains about 39 farms. These farms, considering the character of the soil, and the obstacles to be overcome in the first years of their cultivation, covered as the ground was with a heavy growth of timber and a thick under-growth of bamboo, show very creditable results. This soil is quite sandy and not well calculated for what is generally termed a

mixed husbandry, yet the crops look well and promise good returns for their labor. The crops are those usually grown in northern Japan, consisting of daikon, millet, beans, peas, rape, barley &c., with a limited variety of garden vegetables. These crops with a bountiful supply of fish from the river afford sufficient inducement for quite a community of settlers.

Our next point was on the right bank of the river and below, called Oya-fu. This settlement contains 29 farms. The soil on this side of the river is less sandy, apparently quite rich and well adapted to the growth of the various food plants and fruits proposed to be introduced into this Island. In general these farms are well tilled and for new settlements have a promising look, and well deserve encouragement.

That portion of the Satsporo district lying north of the Ishcari river we found very heavily wooded, perfectly in a wild state, but apparently very rich in soil. for some distance back from the river, I should judge it was subject to inundation, and lying rather low for profitable drainage. The timber consists of elm, ash, oaks, pines, and on the mountain slopes the Yesso firs in great perfection and value.

As we recede from the river and pass over a spur of the coast range of the mountains the land is more elevated and exceedingly rich. On reaching the river Tobets, which is a tributary to the Ishcari, we came upon the isolated settlement of Tobets, containing quite a collection of houses, and about one hundred small well cultivated farms. As usual their crops were mostly confined to those common to this country, they had however made some slight attempts at the cultivation of foreign seeds, sent them through the Kaitakushi, seeds I brought over with me from America, of these the following were doing well, viz.:—Indian corn (maize), pumpkins, melons, cucumber, onions, asparagus, &c. The corn was already in

the "roasting ear," and will do as well here as in any part of the United States.

This population apparently is of the better class. The men appeared well, the women comfortably and decently clothed in fabrics of their own manufacture, and their houses respectable. There would appear to be very little incentive to improvement, yet they seemed anxious to learn, and they would undoubtedly, make the best use of any encouragement the Kaitakushi may see fit to extend to them.

I would certainly recommend that a passable road be cut out, communicating with the outer world, and that an assortment of fruit trees, seeds, and a few pairs of the different breeds of hogs, be sent to these villages, from the Yedo stock which has now accumulated there.

The next farms visited (after passing in review the improvements in and about Otarunai which bid fair to do well) were the quite extensive settlements on the banks of the Yoichi river in the neighbourhood of the town of that name. There are two of these settlement on opposite banks of the river. The first called Kawa Higashi, containing one hundred families, the second called Kawa Nishi, eighty (80) families, both together have a working force of about three hundred able bodied men.

The natural fertility of this soil is rich beyond comparison, the land being "prairie" and clear of stumps and roots would be easily cultivated were it not for the rank growth of weeds which require constant labor to subdue them. As this is only their second year, it is quite amazing to see what physical force unaided by mechanical appliances can accomplish with industry and perseverance. Every encouragement should be extended to these pioneer settlements, in the way of contributions of seeds, fruit trees, &c.

Numerous farms were passed on the trail from the western to the eastern coast. The natural depression in

the divide which separates these two great waters, down which on one side flow the Yoichi river into the Japan sea, and on the other slope the Oshamanba river discharging itself into Volcano Bay from valleys of unsurpassed richness, although not widening into extensive plain, often expand to several miles in width, particularly near their confluence with the seas. The soil throughout is very rich, and great fertility is observable high up on the mountain slopes as shown by the rank growth of weeds and plants which only will grow on very rich soils.

Nestled away in these mountain passes, in places almost unapproachable, over one of the worst mountain trails I ever travelled, is frequently found the Japanese farmer with his well cultivated lots, sure that the land and the river will supply him with the necessaries of life in abundance.

A good road extending from Mori along the shore fo Volcano bay to Oshamomba and through the above mentioned pass from one coast to the other, would open up a fine extent of country, and bring to Hakodate a large trade from the western coast and intermediate settlements from which it is now almost entirely excluded.

My visits to the Government farms at Nanai have been frequent, but not at all satisfactory, no attention has been paid to the advice I gave them on my way up last spring. The money that was appropriated for that place, has been diverted from the most essential work (the improvement of the soil) to the construction of expensive buildings for the accommodation of useless officers, and the place looks ragged and weedy, and instead of being a good, is one of the very worst examples to the Japanese farmer. I am out of all patience with it.

The results of the last two years of experience on this Island, has settled one important and much mooted question, if it has done no more ; and that is the natural fertility of the soil and salubrity of its climate, and this beyond

a question, altogether at variance with preconceived opinion throughout the world, and the declaration of high professors who pronounced it a barren Island in the sub-frigid zone.

Very respectfully,

Yours,

HORACE CAPRON,

Commissioner & Adviser,

Kaitakushi.

No. 12.

TOKIO, September 22nd, 1873.

His Excellency

KURODA-KIYOTAKA DIKAN,

DEAR SIR,—I have the honor to acknowledge the receipt of your letter of the 6th of August, in reply to my several communications under dates of the 9th 13th and 15th of June, and 15th of July.

You seem to be impressed with the idea, that I contemplated heavy expenditures and a reproduction upon the Island of Yesso of the very elaborate and expensive grounds at Aoyama near this City. This is a great mistake, such were never my intentions, and the misapprehension has no doubt occurred from the want of proper interpretation, which has often occasioned misunderstandings.

I have always contended that to insure a healthy and vigorous development and settlement of the Island of Yesso it is first necessary to change the habits and food of its present and prospective population ; that it was folly to attempt a forced settlement depending upon the rice of Nippon as their principal food ; that to be successful, this Island must be self sustaining and produce its own food, not that alone, it should be able to export to other countries. I have further contended, that this was not the work of a day, a year or a few years, but a work

of time, and only to be brought about gradually, aided by practical illustrations, and examples in the manner of cultivating and growing such of the different food plants and animals as are mostly in favor in those parts of Europe and America, which are subject to the same climatic influences; their various uses also, and the manner of preparing them for use as food.

The vast distance of this Island from other parts of the world, from which these plants, seeds and animals must necessarily be brought, required an intermediate point for rest and recuperation, and, in most of the vegetable forms' reproduction. This suggested the establishment of the farms and nurseries near this city, which have since grown into such importance.

These having proved successful, and a large stock of the various fruits and other plants, with various stock animals having accumulated there, their gradual transfer to the Island of Yesso was the next step desired, and it was for this last named purpose that I have so frequently urged the importance of preparing certain ground near Hakodate and Sapporo for their reception, and also, that these grounds should be stocked with foreign improved grasses and plants, which are absolutely necessary to insure the successful introduction of the various animals into this Island. It has also been urged to have certain ground cultivated and properly prepared to receive the great variety of fruit trees now ready to be transferred from the nurseries near Tokio. This has been the extent of my asking, all of which has been totally neglected, or so nearly so, as to hazard a failure in any attempt to transfer either animals or plants at present.

In no case have I desired or intimated a desire for a large outlay of money to carry out these most important objects. All this array of costly buildings, &c. to the entire neglect of the main object it must be distinctly understood is in direct opposition to my often repeated advice.

As auxiliary to this change of food. The small grist mill was erected at Sapporo for converting all these grains—wheat, corn (maize) barley, buck-wheat, rye, oats, &c. into flour (also rice if desired). This was an imperative necessity, as no Japanese farmer on the Island had the slightest idea of the method of preparing these various grains for use, or to what uses they were to be applied.

As regards the preliminary experiments to be made on the farms near this place (Tokei) in the cultivation of various plants, they can have no bearing upon the success or failure in their cultivation on the Island of Yesso, the main causes of all vegetation, namely, soil and climate being both so essentially different. The experience of the past two years upon the Island itself has already settled that matter beyond dispute, and I repeat here without hesitation that all the various food plants grown within the temperate zone on the North American Continent, can be reproduced in perfection on the Island of Yesso.

The next subject upon which I perceive you have misapprehended me entirely is that of *Education*. The remarks contained in my letter of the 15th of July in relation thereto, only have reference to the organization of Institutions of learning in which the higher branches of science are to be taught, requiring eminent Professors at enormous salaries, and not to education generally, nor to preparatory schools of learning suitable to the comprehension and capacities of those to be taught, having regard also to their knowledge of the different languages in which it is desirable they should be taught.

The only case in which I have been applied to for an opinion upon the subject of colleges and schools by any officer of the Kaitakushi, is contained in a joint letter under date of the 30th, 7th month last year, addressed to me while in Sapporo by Sugira Maketo and Matsudaira Taro, on the proposed organization of a college at Nai-

nai. In my reply to that letter under date of September 17th, 1872, you will find that I discouraged the former as premature, and encouraged the latter course.

I have thought proper to say this much upon these two important points referred to in your communication of the 17th, 8th month, merely to place myself right upon the records of the Department.

Very Respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser,

Kaitakushi.

No. 13.

SAPPORO, YESSO,
August 13th, 1873.

His Excellency
KURODA-KIYOTAKA DIKAN,
Kaitakushi, Tokio.

DEAR SIR,—By the terms of my contract with this Government, it is made imperative upon me to watch over, direct and by my counsel, advice and cooperation with the Government authorities here to promote the objects for which this Department was created, namely the development and settlement of the Island of Yesso.

In strict conformity to these obligations on my part, there has not been a day since I first put my foot in Japan that I have not held myself in readiness to meet them faithfully and promptly, as you yourself well know, and the records of the Department bear testimony.

Although frequently meeting with disagreeable, disheartening and often mortifying circumstances, never anticipated under a great Government like this; deprived of all home comforts and associations; exposed to hardships, fatigues and often dangers incidental to a frontier

life in an unpeopled country like Yesso, I have never faltered nor hesitated in the performance of my duties, always acting in good faith, and with an eye to the promotion of the best interests of this department and of the Government of Japan.

Turning over the leaf, we will consider what has been done by this department towards fulfilling its part of the compact. In doing so I desire it may be understood that whatever I may say upon the subject is said with all due deference and respect for yourself as the head of this department, and always subject to any corrections which to you may appear proper to be made.

One of the first and perhaps greatest obstacles to success, is the want of candor on the part of the officials of this Department, and the entire exclusion from me of all information touching the designs or plans of operations, or the means appropriated in whole or in part to carry out those plans. To this day I do not know, neither do I know any one who does know, the amount appropriated for this department either in the gross, or to be expended in detail for any of its operations.

Beyond the single fact that we are laboring for the settlement and development of the Island of Yesso, the ways and means have been a sealed book and I have been compelled to grope my way on in the dark, expected always to be prepared to advise and co-operate, (if not to direct as I had the right to do under my contract), with the properly constituted authorities upon this Island.

This may be in conformity with the customs of this country, if it be so the sooner it is changed the better, no man can do himself or the Government that employs him justice under such conditions.

It must not be inferred from this, that I have been idle since I have been in Japan: far otherwise, scarcely a day or an hour has passed that I have not been subjected to the interviewing process upon one subject or another,

covering a large field of information, from the formation of our Government in all its details, its general, state and municipal organizations and laws, its commercial regulations, systems of taxation, internal revenue and on down from the management of a farm in all its details, to the physicking of a sick animal. I am supposed to know it all and to be prepared to give satisfactory answers upon all questions and upon all subjects. But when the time comes round when for the better understanding of the work in hand, the designs and means at command, &c., it becomes necessary for me to be the inquisitor, that moment pressing business demands attention and the interview is closed.

The result of this one-sided course is evident enough now in the present condition of this department. It is a consolation to me to know, however, that I have foreshadowed this to you in my frequent communications, and forewarned you of the results certain to occur if such a course of action was persisted in. I have also invariably disclaimed all responsibility for acts done without my counsel and advice, all of which is on the records of the department. It is a satisfaction also to know that there is not a case of failure in any one thing recommended or approved by me, but in every case it has been proven that they were for the best interest of the Government.

Since my return to this Island, finding my position embarrassing, my reputation assailed and myself made the "scape goat" for all the delinquencies of the Kaitakushi, I have turned my attention more particularly to its works, their probable cost, present usefulness and prospective bearing upon the future operations for the development of it, and I must say they are far from satisfactory. I shall not stop to repeat these results here, as they have been mostly laid before you in my letters to you Nos. 3 and 4 under dates of June 13th and July 15th, and also in my four several communications addressed to

Vice-Governor Tanaka, marked *A.*, *B.* and *D.*, copies of which were duly forwarded to you at Tôkio, and to which I now most particularly ask your attention.

It appears evident to me from a review of these letters that there are two principal points upon which the success or failure to effectually people this Island hinge. There are unquestionably others equally important, but they are in a measure subservient to and dependent upon the former for success.

The first of these points is, convenient and cheap transit both for passengers and freight between this Island and all other parts of the Empire, and also with all prominent interior points of the Island. The second is a convenient supply of all the necessaries of life at the cheapest possible rates consistent with a free and untrameled trafic with all the other Islands of Japan.

How the first of these has been met by the Kaitakushi is best seen by reference to my letter to Vice Governor Tanaka marked D. in which it is shown from the actual records of the Department that the tariff of charges for transportation by the Kaitakushi—which control the whole, is from four to five hundred per cent higher than the customary charges in other countries.

The next point, cheapness of living, which to the immigrant on his first arrival on this Island is most essential, a reference to my letter marked A. addressed to Vice Governor Tanaka, a copy of which was duly furnished you, will show how far the Kaitakushi has met this matter. It is there shown from the statement of the Kaitakushi officials that the cost of living at Sapporo is from two to three times greater than at Yokohama, and of very inferior quality at that.

It is apparent therefore how completely the Kaitakushi has tied itself up, and closed the doors upon all immigration which was the whole object and aim of the Japanese Government in creating this Department. It has done

more: in grasping the control of every channel of communication with the outer world, it has entirely placed an embargo upon all trade and commerce, the cost of shipment from this place to Tokio, being greater by their schedule of prices than will pay for shipping from foreign ports half round the world.

The real intrinsic value of this Island in its natural resources, its fisheries, minerals, soil, climate, timber, valuable harbors and water communication with all the world, if properly managed would place it amongst the most favored portions of the earth, yet it remains a dead letter and will continue so, a tax upon the Government, unless a different policy is pursued.

The old complicated system of Departmental organization which extends through all grades of the Government works, where there are high officials with a pompous display of sub-officials with their attendants, pervades every branch of the public business here down to the mere saw mill or fishing station. It is ludicrous as well as damaging, and weighs down the most common operations with useless supernumeraries and unnecessary expenses, and fetters all progress with a ridiculous circumlocution of office.

It is idle to look for any healthy and permanent advancement in the settlement and development of this Island under such a condition of things. Old prejudices and old customs which have kept this nation stationary for ten centuries and which are still in full force here, must give way to events which will inevitably be developed in this country by the introduction of Railways and Telegraphs, and the sooner the public mind is educated to it, the better it will be for the country.

Very Respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser,

Kaitakushi of Hokkaido.

No. 14.

KAITAKUSHI, TOKIO,
December 13th, 1873.

His Excellency,
KURODA KIYOTAKA DIKAN,
Kaitakushi.

DEAR SIR,

The preliminary report of the surveying parties which have been engaged in the field during the past season, have furnished sufficient reliable information upon which to base some useful suggestions in reference to the improvement of water communication through the Ishcari river to Sapporo, and the newly discovered coal fields upon that river.

The proposed canal to connect Sapporo with the Ishcari river, at the mouth of the Shinoro, has been found impracticable for the present. The fall from Sapporo to the Ishcari has been ascertained, by a recent survey, to be over eighty three feet, which would require from eight to ten lifting locks, involving an expenditure which the present traffic would hardly justify.

On a further consideration of this matter, I am convinced that a cheap "Tram-way," would more fully meet the demand as a cheap and convenient means of connecting Sapporo with the navigable waters of the Ishcari. The route best adapted for this would reach the Ishcari river at or near the mouth of the Barato, a distance of only about eight miles, over a most favorable surface, and well supplied with material with which to construct the road. Mr. Wasson estimates the cost per mile of a suitable track, with a T rail not to exceed $12,000—per mile. This track would admit the using of steam locomotive power when desired.

The recent soundings, by Lieut. Day, of the Ishcari river, and the buoying out of its channel over the bar at its mouth is a most important work, and furnishes much

needed information in regard to the navigability of that stream hitherto unknown.

It appears that we have a depth of water over the bar at all seasons, of twelve (12) feet, and that the river channel carries a depth of three (3) fathoms to the mouth of the Shinoro, and over fourteen (14) feet to the mouth of the Horumui, in the vicinity of the recently discovered coal fields.

The width of the bar at the mouth of the Ishcari is only about nine hundred (900) feet, which could easily be dredged to the depth of fourteen feet. This would enable vessels drawing twelve feet to ascend the Ishcari to the vicinity of the coal fields or the mouth of the Horumui about twelve miles from the coal deposit.

There are some peculiarities in this bar which it is well to notice; it appears from the reports that the channel changes every year upon the occurrence of the spring freshets. This will make it necessary to have the channel examined and buoyed out on the recurrence of these heavy freshets, and also in the event that the channel is deepened by dredging, it will require to be repeated at the same time, but as the extent of this is quite limited, the expense with good dredging machinery will not amount to a very heavy tax.

With the present depth of water upon the bar, good side wheeled steamers carrying from fourteen (14) to eighteen (18) hundred tons of freight, may pass in—probably seven months of the year, and ascend to the mouth of the Horumui. This is an important fact hitherto not properly understood.

"Screw steamers" are not suitable for that river for two important reasons. They draw far too much water in proportion to their carrying capacity, and are liable to have their screws twisted off by the snags which are brought down by every freshet and anchored in the stream. In the event of a large commerce upon this

stream these snags will require to be removed annually, but as the fishermen along its banks generally do this for their own convenience every spring, there would be little more necessary than a careful examination of the river, and the removal of any remaining obstructions.

As a sample of a good sea going side-wheeled steamer, suitable for this traffic I would refer you to some of the United States steam ships, I believe now in these waters. These vessels have a carrying capacity of about eighteen hundred (1800) tons, and draw but eight to nine feet of water when loaded to their full capacity. Ships of this class can now pass into the Ishicari and up to the vicinity of the coal fields with perfect safety, sailing by Lieut. Day's chart, whenever the few remaining snags are removed or properly buoyed.

Ships of this class are capable of transporting coal directly from the mouth of the Horumui to any southern ports of Japan or to China; and can at the same time be used for towing vessels over the bar and up the stream to that point.

In the event that it is concluded to use this as the route through which to transport this coal to a market the tramway from the mines to the river should be so constructed as to deposit the coal directly into the hold of the vessel; this is necessary both for saving in expense of handling the coal, and the consequent great loss by abrasion from the same cause.

A good depôt at the termination of the tramway from Sapporo, would enable you to ship all articles from Tokio or Yokohama direct to Sapporo with but one transhipment at that point, and thus reduce the time and cost of transportation to a reasonable rate.

With ships of the class above named. the western coast of that island would be well accomodated and Sapporo provided with a more direct communication with the other

parts of the Empire, which will serve until the more desirable route through Shin Mororan is provided.

Very Respectfully,

Yours

HORACE CAPRON,

Commissioner and Adviser,

Kaitakushi.

P.S.—I omitted to mention the important fact, that off the bar at the mouth of the Ishicari, there is good "holding ground" with six to eight fathoms water, only exposed to the west and northwest.

H. C.

ABSTRACT

OF

SECOND ANNUAL REPORT,

OF

HORACE CAPRON,

COMMISSIONER AND ADVISER

KAITAKUSHI OF HOKAIDO.

FOR

1872 AND 1873.

TOKEI, JAPAN.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1874.

Tokei, Japan, November, 1874

To His Excellency,
KURODA KIYOTAKI,
KAITAKU DIKAN,
KAITAKUSHI.

SIR,—I have the honor to address to you the following Report of the operations of the Kaitakushi as they have been presented to me from time to time and as the result also of personal observation and inspection in the course of my duties as the Commissioner and Adviser of this Department of the National Government. I beg leave not only to speak of the progress made in the settlement and development of the resources of the island of Yesso, by means of the labors of this Department, but also to speak freely of any failure to put into full operation the plans as understood and advised by myself.

My tour of inspection and observation gave me ample opportunity not only to see the progress which had been made in carrying out these plans, but also to note any lack of thoroughness in their execution. In speaking of any omissions, which I may have seen, it will not be done in any spirit of criticism or fault-finding, but with a view that such omissions may be supplied in the future, and thereby the success of this Department be more fully assured.

At the time of my arrival in Japan there was little or no reliable information as to the soil, climate or universal resources of the island of Yesso. The prevailing opinion with all people, foreign and native, seemed to be that it was a rough, mountainous, barren country with a sub-frigid climate, which rendered it nearly, if not quite, uninhabitable. The report of a member of the party, which I sent to that island in the summer of 1871, was in confirmation of this popular opinion. This report explicitly states that the summer temperature is such as to render the cultivation of Indian corn impossible. I was satisfied that the popular belief and the opinion of this member of the party was not well founded. I therefore instituted a thorough investigation into the climate of Yesso, and from the meteorological notes, taken at Hakodate through a term of years, from the known influences of thermal ocean streams like those which sweep around that island, and from a study of the various natural vegetablep roductions, I became convinced that everything could be grown there which is produced in the United States of America north of the 40th parallel of latitude and that Yesso offered inducement enough to attract a large immigration. Upon that judgment I based my report of January 1872. At the time of making that report, which contained a plan of operations for this Department, I labored under the disadvantage of a want of a full knowledge of the designs of the Department. I was not informed whether the Government intended to expend a large or small amount of money for the development and settlement of the island. I therefore based my plans upon a limited expenditure, which proved much less than was required although I based my estimates of the cost of the improvements to be made in the island upon the cost of similar works in the United States, where labor is comparatively dearer. It is my purpose in this report to show, what part of the plans submitted by me, and

adopted by the Department have been carried out, and what the Department has done without or contrary to my advice. The following are the principal measures contained in the plan of operations to which I allude.

First.—A thorough Geological, Meteorological and Trigonometrical survey of the whole island under able engineers.

Second.—The enactment of the most liberal laws regarding the occupations of these lands. An outline of the required laws for this purpose was given in full.

Third.—The construction of good wagon roads between the important points of the island.

Fourth.—All possible arrangements to provide cheap transportation between Yesso and the commercial ports of the other parts of the Empire.

Fifth.—A safe and judicious development of the mineral resources of Yesso by means of a system of royalties paid to the government by private parties, or by the working of the mines by the government under the immediate supervision of experienced mining engineers.

Sixth.—The utilization of the lumber of Yesso by means of the erection of saw-mills on water-courses, capable of floating the largest saw logs.

Seventh.—The extension of the fisheries with improved modes of taking, curing, packing and carrying the fish.

Eighth.—The planting and growing of nurseries both in Nipon and Yesso for all foreign fruits.

Ninth.—The establishment of model farms on both these islands on a scale sufficiently extensive to experiment in the production of all the food plants of Europe and America, as well as for the introduction of improved breeds of horses, sheep, cattle and swine; also for the introduction of the most improved kinds of farm implements and machinery and the instruction of the people of Japan in their uses.

Tenth.—Radical changes in the style of dwelling for the settlers of Yesso, substituting substantial wood and stone houses for the thin paper ones in use.

Eleventh.—The improvement of the water-courses of the island for purposes of navigation and for water power.

Twelfth.—The establishment of a system of public schools for the education of all the people of the island.

This is a brief summary of the measures recommended by me in my report of January, 1872, and in subsequent letters. Two years have elapsed and I see no reason to change my views of the climate, soil or resources of Yesso, or to change a single recommendation contained therein. On the contrary it is my opinion, that, had these plans been thoroughly carried out by this Department in an energetic and economical manner, the great difficulties now presenting themselves would have been long since overcome and large sums would have been saved and this Department would have been one of the most popular and useful of this Government.

Following this résumé of my recommendations, I propose to review the labours of the Department during the two years and see what has been done, and what has been left undone.

First.—The Surveys: Geological and Trigonometrical.

The geological survey failed entirely for 1872 from the disaffection of my assistant to whom it was entrusted. The trigonometrical surveying parties were prevented from taking the field that season from a want of the proper instruments. The results of the season of 1873 have been far different. The geological and mineralogical party was under Mr. Benjamin S. Lyman, assisted by Mr. H. S. Munroe. The trigonometrical surveys were in charge of Mr. Jas. R. Wasson, assisted by Lieut. Murray Day, U.S.N. The reports of these various parties will give the most important practical knowledge of the natural

resources of Yesso and will prove valuable contributions to science.

Second.—Suitable laws, relating to the occupation of the land by settlers.

So far as I know, this recommendation has not been followed by any action whatever, and I find that after so much time the need for such a system of laws is greater than ever.

Third.—The construction of thoroughfares.

In the Spring of 1872 there was not a rod of wagon road in Yesso, nor was there a street in any of the towns or villages, where a wheeled carriage could pass. Since that time there have been constructed the following roads :—

From Hakodate to Mori.....	27	Miles.
„ Mororan to Sapporo.....90		„
„ Sapporo to Otaruni.....23		„
„ Sapporo to Shinora 8		„
Streets opened and graded in towns and villages.....	25	„

The total number of miles of streets and wagon roads constructed is therefore 173. The construction of these roads has been thorough, and they would be a credit in any country.

4th.—As to cheap transportation I cannot learn of any advance towards cheaper rates. This Department has every means at its command to accomplish all that could be desired. With a large fleet of vessels subject to the Department the rates of freight from Tokio to Sapporo are higher than from San Francisco to Yokohama, and the time consumed in the transit of freight is greater.

5th.—The development of the mineral resources of Yesso has not been as great as could have been expected. Although I cannot with the present knowledge of the mineral deposits recommend the outlay of any large sums of money for the opening and working of these mines, I

would again urge the adoption of such rules and regulations as will induce private parties to work them under a system of royalties.

6th.—The utilization of the lumber.

The importance to this Department of bringing into use the valuable lumber of the island has been often urged. As an initial step towards it two saw mills have been erected at Sapporo, one operated by steam, the other by water power, and both are in successful working condition. A canal has been cut, leading from the Toyohira river into two large reservoirs at the mills, with sufficient capacity for several million feet of burthen, and logs for that amount have already been cut and floated down to the mills. About one million feet of plank have been sawed, one-half of which has gone into construction of buildings at the place, the balance has been piled and protected from the weather to season for future use or exportation. These mills are now in full work. In connection with these saw mills, which are capable of sawing twelve thousand feet of timber daily, is a well built structure, supplied with power by a turbine wheel of the most approved kind, sufficient to propel a number of valuable labor-saving machines for planing, tongueing and grooving material for floors, for making window sashes and panelled doors, shingles, laths &c., &c., and for other useful purposes and for converting this lumber into any desirable shape for house use or exportation.

No arrangements looking to a market beyond the immediate wants of the place have been considered by this Department, although often urged by me. The source from which could be derived more real net revenue to this Government than from all the minerals in the island—leaving out of the question its coal—is suffered to decay, while at the same time lumber in considerable quantities is actually imported from America, five thousand miles away, to this country and to China and other markets.

7th.—The Fisheries.

The manner of preserving fish for market, which has been followed for centuries without any change is still in practice. The fish thus prepared are unfit for any but Chinese and Japanese markets. A trade, which might otherwise be a source of very important revenue to the country, is confined to very narrow limits. As the demand for most of the kinds of fish found within these waters is very great, some attention should be given to their preparation to suit the different markets of the world, which would no doubt make this a very lucrative trade.

8th.—The importance to the country of the nurseries and farms in the vicinity of this city cannot well be overestimated. Yet I fear at the present time they are not fully appreciated by the people of Japan. The following is a partial list of the stock and material already collected on the farms near Tokio.

About fifty head of thorough bred cattle of two of the best breeds known (the Short-Horns and the Devons); one hundred head of full-bred sheep of the best breeds, comprising the Southdown, the Merino and the celebrated Lincoln breed from the herd of Mr. Samuel Campbell of New York. We have also a few specimens of the Spanish merino and a number of sheep, whose wool is of medium grade, neither coarse nor fine, also two stallions of the best breed of horses in the United States for all purposes, whether for the road or the farm.

Of fruits, which are now well established, there are in all about forty thousand plants, embracing a great variety of the best apples, pears, apricots, plums, cherries, grapes, with all the smaller fruits as currants, gooseberries, &c., &c., also about ten thousand thrifty grafts upon native stocks, and eleven thousand standard trees, embracing a great variety of the best foreign fruits, which

are set out in orchard form, and which will in another year begin to bear fruit.

Ninth.—As important to this food question it was found that after the wheat, corn, rye and other grains had been grown in Yesso, the Japanese were ignorant of their use, or the manner of preparing them for use. A good grist mill was therefore erected at Sapporo and put into complete operation, turning out finely bolted flour and meal to the great admiration of the people assembled, who were astonished to see so great an innovation upon their old customs of pounding their rice and other grains, or grinding them by hand. This may be considered the pioneer grist mill in Japan, and will form an important era in the settlement of Yesso.

Tenth.—In the above list of improvements many others of great value might be added, as the work of the Kaitakushi during the past year. At Sapporo there have been erected many substantial buildings in foreign style. They consist of a substantial, and sightly building for a State House and Public Offices. A large number of dwelling-houses of the better class of buildings in foreign style of architecture and quite a large number of the old Japanese order, sufficient to accommodate it is said, a population of four thousand, which have already been collected in and around that town.

The country in the immediate vicinity of Sapporo has been greatly improved, and there are many farms well tilled by Japanese farmers, who supply the markets of that place. The Kaitakushi has also opened a small farm, on which all foreign grains and food plants flourish as well as in any part of the world.

The improvements in and around Hakodate are equally creditable. Streets have been widened, straightened and properly graded, large ranges of foreign-built houses and many public buildings have been erected, and, what is a novelty in that place, have been properly painted. The

city, which in 1871 bore the appearance of a dilapidated old fishing station, wears now the appearance of a thriving, cheerful town with largely increased population and business prospects.

A number of farm settlements, embracing from fifty to two hundred families each, have sprung into existence within the last two years, mostly upon the fine water courses and the newly opened roads, where the soil is universally fertile and fish convenient and abundant. Such settlements give most encouraging prospects for the future of the island and furnish the most convincing proof of what I have so often repeated in my various communications to the Department, that under a liberal and enlightened policy the intrinsic value of its own resources is sufficient attraction to insure the full development of the island.

From the consideration of these measures, which have contributed so much towards the past success of this Department, and which give such promise for the future development and settlement of the island of Yesso, I turn reluctantly to the consideration of some operations of the Kaitakushi, which, in my judgment, have not been wisely considered nor judiciously carried out. I allude to some of the public works, which have been in part or wholly constructed in Yesso. Amongst them I will enumerate as the most important:—the great pier at Mori;—the docks, piers and warehouses at the Ishcari river;—the unfinished reservoirs on the Toyohira river;—the new dam and bulk head on a branch of the Toyohira river leading off through the town of Sapporo;—the opening of the stone quarry more than eight miles from Sapporo where the stone is required for use and the construction of a road that distance. I mention these, as they are of the greatest magnitude and much the most costly in their construction. There are others which I need not enumerate in this report. At the time of the initiation of such

of these works as I was consulted in relation to, I protested against their construction, either because they were not wanted at their locality, or were not adapted to the requirements for which they were intended. These protests are on record in the Department and are mostly to be found in my letters from Hakodate of July 8th, 1872, and from Sapporo June 15th, July 15th, and 13th of August 1873 &c., &c.

I do not enter upon the discussion of these matters with a view to arraign the officers of this Department, but in order to place myself correctly on its records. Those upon whose authority these works were planned and constructed, in case of their failure to meet the requirements for which they were intended, should bear the responsibility of failure; on the other hand, in case of success, they receive the full credit of success. As I had no connection with them I shall not claim the one and hope not to incur the other.

I shall rejoice to see these works vindicate the foresight and judgment of those who planned them by proving to be all that is desired and expected of them in advancing the interests of the Government.

There are questions bearing upon the future efforts of the Government to people the island of Yesso, upon which a more extended knowledge of this country has thrown much light, but none of more importance than that of the sources from which the necessary population is to be derived. Before and on my arrival in Japan I was led to believe from the current reports of the estimated population of the island of Nippon, that it was teeming with a dense population, which was already pressing upon its boundaries and seeking space for expansion. Forty millions of people—as represented—upon an island of the superficial area of this, upon which it is mostly concentrated, would naturally lead one to infer that the only barrier to its natural overflow into the island of Yesso

was the dread of a more vigorous climate and reputed sterility of soil. The fact, however, that the island of Nippon is not more than half occupied, and that it is capable of sustaining nearly double its present population, under its present system of high cultivation and the simple, primitive mode of living of its inhabitants, takes from us the expected aid of a powerful necessity for an outlet for an overcrowded population and compels us to rely upon the superior inducements the Island of Yesso may offer under a liberal and enlightened policy. Under existing circumstances, without this aid it will be idle to expect a voluntary emigration from the milder climate of Nippon to the colder one of Yesso, and great inducements must therefore be held out, as I have repeatedly urged in my reports and letters to this Department.

It is worth while, also, to consider the indirect influence which a proper administration of the affairs of the Department may have upon the whole country, by the introduction into Japan of the various food-plants, fruits, animals, implements and improved modes of cultivation, that are found amongst the chief countries of the globe.

The population of the island of Nippon appears mostly to be concentrated upon and along the vicinity of the rice producing lands, that can easily be overflowed, whilst the high rolling lands are to a great extent unoccupied and uncultivated. Rice to a limited extent is grown upon the higher lands, but such cultivation is neither found desirable nor profitable. It may, therefore, be a question whether even at the present day the rice producing capacity of the island of Nippon has not reached its highest point and whether a much larger augmentation of its inhabitants may not soon drive them to the cultivation of food-plants and fruits, which may be profitably grown upon the more elevated lands. It is true that there is generally a surplus of rice over the present consumption, but this will always be required to guard against a famine

where the main reliance for food is upon one single variety of production. If this suggestion should not prove correct, there are still other reasons, why the introduction of all the agricultural varieties must be found of great importance to this country, namely the fact that rice is one of the most expensive of all food plants cultivated and yet, in nutritive properties, 170 pounds of it contain only as much nutriment as 107 pounds of wheat. Another important point is the natural change in the tastes and habits of the people, and the demand for a greater variety in their food, resulting from the introduction of foreign ideas and ways of living. It may not be unworthy of consideration, how far the transfer of any considerable portion of the present rice-producing population of this island to that of Yesso, there to become consumers, if rice is to continue their principal food, may affect the food interests of this country.

These are matters to be considered in connection with this movement, but in no event can the work of the Kaitakushi, if properly administered, fail to affect favorably the interests of the whole Empire.

In concluding this report I cannot speak too highly of the services rendered during the past year by my assistants in the surveys, and of the energy, industry and ability displayed by them on all occasions. I must also call attention to the labors of my two American assistants at the farm near Yedo, Mr. Belmer, in charge of the Horticultural Department, and Mr. Dunn, in charge of the farm and stock. I will also add, that what has been accomplished is so small a part of the great labor of settling and developing a great island, that to those not engaged in the work it may seem that but little is doing; but settlements are not made in a day; they are the growth of time. If we have sown the seed properly, the harvest will be only a question of time. I feel confident that the labors of this Department will result to the general good

of Japan, and will be of the greatest and most enduring character and will justify all that has been hoped from them.

Very Respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser.

KAITAKUSHI.

PRELIMINARY REPORT

ON THE

FIRST SEASON'S WORK

OF THE

GEOLOGICAL SURVEY

OF YESSO,

BY

BENJAMIN SMITH LYMAN.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1874.

SHIBA, YEDO; 25th December, 1873.

To the Honourable

K. KURODA,

Jikuwan of the Kaitakushi.

SIR,—My orders on leaving Sapporo were to report to you fully at Yedo in regard to the past season's geological work in Yesso. As it will take some time to work up the details and set them forth in maps and full reports, I hasten now after arriving at Yedo to give you a sketch of what has been done, its nature and its probable results.

The work according to your instructions has been confined to the four south-westernmost provinces, Oshima, Shiribets, Iburi and Ishcari, about one-third of the island. Indeed, only the lower part of the province of Ishcari was visited, by the direction of Governor MATSMOTO; since nothing of mineral value was reported from the upper waters, and it would have taken three months or

more to visit them, and there was little prospect of seeing much of geological interest without making, in addition, long and difficult excursions away from the almost unvarying alluvial plains that border the river itself.

Within the region examined the aim has been to learn something definite in regard to a few important points at least, rather than even to go over much more ground and obtain only vague and wholly imperfect information; since it is certain that the one method gives results ten times more valuable than the other. All places, however, where useful minerals were reported to exist have been visited, with scarcely a single exception, even though they often proved to be worthless either in quantity or quality; and in passing from one point to another, an effort has been made to learn as far as possible the general geology of the region aside from its useful minerals merely.

For this purpose also a number of fossils have been collected at several places; and they will probably be useful not only in recognising rocks of the same age at other points in Yesso, but in determining their age as compared with the rocks of the rest of the world, and so possibly enabling conjectures to be formed sometimes of the quantity and quality of certain minerals they are likely to contain. A more minute study of the fossils is of great interest to paleontologists and of great value for the progress of learning, and I would urgently recommend placing the collection in the hands of somebody specially skilled in such matters, to be studied, described and published. As our libraries here in Japan are too defective in this branch of learning, to say nothing of the lack of a man well fitted for the study, it would probably be best to send the fossils abroad. There are yet too few fossils and too little prospect of large additions to the number hardly to justify the employment

here for the present at least of a foreign paleontologist for Yesso alone. For the education of the youth of Japan, in general, it would however no doubt be desirable to have such a foreigner come here, and if one should come, these fossils might be turned over to him.

In the survey, the American, Pennsylvanian topographical method has been used; for the creation and improvement of which, not only in the working details on the small scale, but in the discovery of its general laws on a large scale, geology owes so much to Professor J. PETER LESLEY, of Philadelphia; as I had the honour of showing about two years ago in a paper read to the American Institute of Mining Engineers. That method is indeed, as compared with others in geology, what quantitative analysis in chemistry is to mere qualitative analysis, and is no less important for theoretical purposes than it is useful for practical ones. It strives to determine the extent and position of mineral deposits both underground and at their outcrop, by means of laying down on paper the shape of the surface of the ground (by contour lines), as well as all the dips and strikes of the rocks that can be observed; so that the contour of any rock bed or vein may be drawn as it is even underground, and its contents above or below any given level or within any given limits may be calculated. In short, the surface and the deposit are geometrically constructed on paper. Of course, just as a chemical quantitative analysis may be more or less exact according to the difficulties of the case, so these geological surveys are only roughly exact when poor instruments are used or when the case is specially difficult; but in almost any case are far better than merely qualitative observations alone. They are, in fact, as far as they go, definite and precise; while ordinary geological surveying, so called,

gives vague and conjectural results, just as the qualitative analysis of a mineral enables the quantitative composition only to be guessed at.

The topographical method moreover gives by its maps very much the best means of compactly and clearly setting forth to others, observed geological facts and the conclusions arrived at. From such a representation of the facts, inferences can readily be drawn by others independently of the observer's opinions, confirming or opposing his judgment. The results of the season's work then will be not merely personal opinions, but facts so gathered and arranged that in future any other geologist can form his own conclusions from them with no need of revisiting the ground, unless a more detailed survey should be desired.

A quantitative measurement naturally requires much more time and work than a mere qualitative one; and that has hindered the more general adoption of LESLEY's method in countries where time and work are dear, in spite of its abundantly countervailing advantages; and has even caused professed geologists to remain in ignorance of it and of its merits. There is perhaps no country in the world whose surface has already been topographically mapped minutely enough to answer in a detailed measurement of the rock deposits; and only few countries which have been mapped well enough for somewhat more general geological purposes. It is therefore necessary for the geologist to undertake the mapping of the surface as well as of the underground features; and he can do it better for his purpose than a mere topographer, because his work is guided by the geological structure.

The assistants you kindly furnished me have added very much to the amount of work that could have been done by any one man; even though they were young

and inexperienced, and for the most part wholly ignorant at the outset, not only of geology but of surveying, drawing and even almost of common arithmetic. They have been very useful, partly because they have eagerly and rapidly learned what they could in a very short time; and partly because such surveys require much work of a comparatively very simple character.

Mr. HENRY S. MUNROE, the American assistant, was, by his former studies, much better fitted than the Japanese assistants for undertaking such work, although it was in great part practically new to him. He entered upon it with interest and intelligence, and has worked industriously and faithfully. He was especially useful at first in teaching the others drawing, and in the field has had charge of the details of the work of one-half of them and the whole management of the gold surveys, under very general instructions. Of the Japanese assistants Mr. T. YAMAUCHI by his greater age and therefore more advanced education and matured judgment has easily stood at the head. Mr. H. SATOW, besides his remarkable success as interpreter and his good service as an assistant in surveying, has with admirable zeal made for us an excellent botanical collection. My quartermaster since August, Mr. Y. AKIYAMA, from mere love of learning, frequently made himself very useful also in surveying though it was quite outside of his required duties to do so. He has therefore more than replaced the single assistant whom it was found necessary to dismiss. Mr. MUNROE's quartermaster, Mr. S. ICHICHI, has kindly improved the opportunity of his abundant leisure on the Toshibets by making an interesting collection of insects. All the assistants, (including besides those already named, Messrs. INAGAKI, KUWADA, MISAWA, TAKAHASHI, KADA, SAKA and SAITO,) with a laudable desire to do even more than their mere duty, and to help

forward the interests of the survey—and with eagerness for their own improvement—have done more than could be reasonably exacted from them; or, at any rate, in addition to bearing many hardships cheerfully, have worked harder, both bodily and mentally, than even labouring men in Japan are commonly expected to work with their bodies alone.

I have tried to turn the assistants' services to the best account by giving them the simpler but more time-taking work to do, while I myself (after they had had a few weeks' practice) visited a larger number of places more rapidly, and attended especially to purely geological observations, where either little other work was required, or where it was done by the rest.

Besides the aid they have given, notice should be taken of the benefit to them and to the empire of the knowledge these Japanese have gained by their season's labor. They are not only the first Japanese but the first Asiatics to undertake the study and practice of geology; and although the training of native geologists in India has been begun nearly at the same time, (or is soon to begin), I trust that ours will continue to take the lead, and that Japan will become in a few years independent of foreign countries in their profession. The young assistants have not only learned something of surveying and geology, but have in the field work, had under them each two or more laborers for rod-men and choppers, and have therefore gained a little experience in the management of men—a matter of very great consequence, if they are ever to be put in charge of important mining works. It is, however, a matter too apt to be wholly neglected in the training of the young men in all but the military schools of foreign countries, although quite as needful in civil or mining engineering or in agricultural affairs as in military.

On account of the shortness of the time for preparation and practice before going into the field, the Japanese assistants neither learned the use of the larger and more exact kinds of surveying instruments, nor were such instruments received in time and in numbers enough to be made much use of; in fact only two came to hand in the course of the summer, and one of them in a poor condition. The surveys therefore were almost wholly made with small and in part badly made instruments, generally without the useful occasional checks of a larger one. Still, the surveys made this season were mostly of a somewhat preliminary nature and required less exactness than would be needed in the actual working of a mine; and they are in that respect probably satisfactory enough for present purposes. The measurements were mostly made with prismatic compasses, hand levels, aneroids and pacing; and owing to the partial balancing of the numerous small errors, sometimes less sometimes more than the exact truth, the errors of the results were far less than inexperienced surveyors would suppose. Between the exactness of such results and merely conjectural mapping, by even the best head most familiar with the ground, there is simply no comparison whatever. For another season it would be very desirable to have at least a few somewhat larger, light, more correctly made instruments, by which with a stadia both compass or transit running and levelling and the measurement of distances could be done almost or quite as rapidly as they could be with this year's instruments and much more exactly. Surveys with such instruments of the better kind would be satisfactory as far as they went for working maps in any possible future mining.

It is a great advantage to have the first rough mapping of such surveys keep pace from day to day with the field work, but owing to the changeableness of the climate,

(which sometimes brought several rainy days together), and owing to the inexperience of the assistants in office work, so that it would have required more time, and for other reasons, it was on the whole thought advisable, this year at least, to leave much of even the rough mapping to be done in the winter after returning to Yedo. This arrangement has enabled somewhat more field-work to be done, and has made the employment of the laborers and some other matters rather more convenient; but, besides the disadvantage with respect to the surveys themselves, will lessen the time that the assistants can give to other practice and studies during the winter, and will therefore leave them next spring less well fitted than they otherwise would have been for another season's work.

In determining the importance of the points to be more carefully surveyed, regard was had chiefly to their mining value; for the importance of any one of them in respect to theoretical geology was sure to be great enough; and it was likely that those that should be specially studied would throw such light on the general geology of the island as to make it comparatively easy to fill up the gaps with sufficient exactness by the time the whole of Yesso should have been gone over on the present system. In regard to the general geology of the field of this year's work some important points remain still undetermined, such as the relative age and the superficial extent of certain groups of rocks; but some of them will perhaps be made known by the winter's mapping; while others may be cleared up by the surveys of other parts of the island, or may possibly require special examination at some future time.

Many places were visited where valuable minerals had been supposed to exist, but where they proved to be deficient either in quantity or in quality. Indeed, on

the island of Yesso as almost everywhere else, the chief directly practical benefit of a geological survey is far more in saving the expense of foolish outlay in mining worthless deposits than even in guiding productive work, and much money would have already been saved in Yesso if competent men had long ago been employed to examine the deposits properly, and authoritatively discourage the working of mines whose ruins now remain as marks of the hopefulness of human nature. This hopefulness here, as in other countries, leads most men to the ruinous belief that the part of a deposit that is hidden deep within the earth, is better than the part exposed near the surface; so that good deposits are sure to be worked, however, unskilfully even without the recommendation of a geologist; while bad ones are apt also to be tried until his advice puts an end to further waste of money. It would be very interesting if the millions wasted all over the world in foolish mining that would have been prevented by a good geological examination could be compared on the one hand with the perhaps hardly greater profits of successful mining, and on the other with the relatively trifling cost of such a survey.

On coming to Yesso towards the end of April we went at once to Sapporo according to the instructions given at Yedo, expecting to begin at that time the survey of the country to the north, hitherto geologically unexplored. But owing to the reported high stage of the Ishcari River we were directed to go first southward for forty or fifty days to the coal mines at Kayanoma and its neighborhood, After finishing the coal survey, I sent Messrs. Munroe, Satow, Inagaki, Misawa, Kada and Saka still further southward to make a somewhat detailed survey of the Toshibets gold region, against my visit there in September, and then to go on towards Hakodate; as they afterwards did, making rapid surveys of the small

gold regions near Kudow and Esashi, and of the lead mines at Yurap. The other five assistants and myself arrived again in Sapporo at the end of about fifty days having visited the gypsum at Yunai in the Raiden mountain (apparently too poor to work); the zinc blende, galena and copper pyrites vein near Yudomari and Sakkadzuki (quite too thin to work); and the place of the supposed traces of coal at Furubira (merely a lump of coal that had been brought, no doubt, by some boat or by the hand of a man, and dropped on the river shore). On the way, moreover, according to instructions, we went quite around the Shakotan peninsula, without however hearing of any minerals of economical importance; though we had an interesting view of the rocks as we passed along, sometimes by land where there were roads, at other times by sea. After a week of office work and preparation we set out from Sapporo for the coal field on the Horumui, a branch of the Ishcari; from a rapid survey of which we returned to Sapporo in just a month, after many unexpected delays occasioned by the weather and other causes beyond my control.

From Sapporo I sent Mr. Yamauchi and the three other assistants then left with me, to Horikap to make a small addition to the Kayanoma survey, against my revisiting that place in company with General Capron; and myself visited the blende, galena, pyrites and orpiment place (worthless as it turned out) near the Jôzan hot-springs on the upper waters of the Toyohira; and afterwards according to instructions, accompanied General Capron to the mouth of the Ishcari, to Tôbets, and then to Iwanai, Horikap and Kayanoma, on the way visiting the pyrites place near Rubeshibe, which proved however to be quite insignificant. After inspecting the work of the four assistants at Horikap and making a survey of the Chatsumai and Shibui harbors and a visit of explora-

tion across the mountain to the Furubira River, I took the assistants to the Iwaonobori sulphur place, and made with their help a hasty survey of it. From there I sent them to begin surveys at Yamukushinai and Washinoki; while with Mr. Akiyama I went myself across the Shiribets valley to Usu on the east coast, and visited the sulphur place there, which turned out to be wholly unimportant. We went thence still further north-eastward along the coast to the sulphur place at Nuburibets hot-spring, and then to the one on the top of Tarumai volcano. Returning south-westward we visited some newly discovered ores of zinc, lead and copper on the Horobets, and found them too poor to work; and also investigated a reported discovery of coal at the mouth of the Washibets near Mororan; but it proved to be several lumps of coal that had been washed ashore from a wrecked steamer. Then following the sea shore as far as Kunnui, we went to the gold mines on the Toshibets; but as Mr. Munroe had just gone with his party to the Kudow gold field, and by some mistake had left none of his mapping behind and no special information in regard to the surveys he had made, after a day or two of examination of the gold washings we went to Yamukushinai. Here with the help of the rough mapping of Mr. Yamauchi's party the oil place and the iron ore sand of the beach were examined and the daily yield of oil was measured.

From Yamukushinai Mr. Akiyama and I made a short trip to the old lead mines of Yurap, and left somewhat detailed instructions in regard the survey to be made there by Mr. Munroe and his party. Thence we went to Washinoki, visiting the Boro and Kusuri hot-springs while passing Otoshibe. At Washinoki, the oil place was visited and the geological observations of Mr. Yamauchi and his party were reviewed, and their other work just

then finished was inspected. They were then sent to Idzumisawa to make in like manner a map of the oil place there. Mr. Akiyama and I fixed the position of the Washinoki limestone, and visited the Nigorikawa hot-springs and the Torizaki insignificant lignite and oil gas, all near Washinoki. Then going south-eastward along the shore, we visited the Tomi hot-springs near Shikabe; the sulphur place (unimportant as it proved) on the top of Komangadake; the Shikabe hot-springs; the Isoya hot-springs; the Kemushitomari lignite between Isoya and Kumadomari (found to be quite unworkable); the Obune hot-springs; the Kakumi hot-springs; and the Esan sulphur mines of some importance. Then turning south-westward and westward along the shore towards Hakodate, we visited the Kobui gray sulphur mines; the Kobui iron sand; the Setarai worthless pyrites and calc spar; the Ishizaki limestone; the Yunokawa hot-spring; the Yunokawa kaolin; the Kami-Yunosawa limestone and hot spring. Then westward from Hakodate we visited the Idzumisawa (or Kamaya) oil spring, and with Mr. Yamauchi and his party reviewed their geological observations and inspected their whole survey at that time about finished. Then we visited the Mohejikawa brick kilns and clay pits; the Tomigawa lignite (quite unworkable, as it proved); and the Ichinowatari long abandoned lead mines (very justly abandoned as it seems). Then, with Messrs. Yamauchi and Takahashi, we visited the very abundant lime-stone of Garonosawa; and on our return were joined by Messrs. Kuwada and Saito, and we all came to Hakodate on the first of November, the field work all done. The next day was very stormy and much snow fell at the Yurap mines where Mr. Munroe's party had been working; and they all hastened, in accordance with my instructions, to Hakodate. They arrived on the seventh; on the ninth much more snow fell even around Hakodate; and on

the tenth we all sailed for Yokohama and came directly to Yedo.

The part of Yesso surveyed so far, contains the following groups of rocks :—

Alluvium, new and old.

Volcanic-pebble Rocks.

Volcanic Rocks.

Rocks of the Toshibets Karafto System of Folds.

Coal bearing Rocks, or Rocks of the Horumui Kuril System of Folds.

Rocks of the Horumui Karafto System of Folds.

Rocks of the Toshibets Kuril System of Folds.

Alluvium.—Along the Ishcari River are rich alluvial plains, in all about fifteen miles (six ri) wide and forty miles (sixteen ri) long ; and similar smaller plains are found bordering all the large streams, the Shiribets, Toshibets, Yoichi River, Horikap, Yurap, and many others not so large, making admirable farming sites, only with the lack of roads at present. The soil indeed seems to be very good even on the uplands, and supports a rich growth of wild plants. The chief exception is in the neighborhood of Tarumai volcano, where for many miles around even the low plains by the sea-shore have so lately been covered by pumice as very much to lessen their fertility. Yet even here a rich black soil, in some places six feet thick, exists at the depth of only about a foot below the surface of the ground.

On the Horumui, the Toyohira and elsewhere beds of lignite and peat, three feet or more thick, are exposed in this alluvium, very recent looking lignite with the woody fibres and form plainly seen. This lignite is also found in bits on the Shiribets and on the Furubira. At Kobui there are eight feet or more of peat.

A somewhat older alluvial deposit almost everywhere along the coast forms gently sloping plains, from a few yards wide to several hundred, between the mountains and the sea-shore, often spread out in fan-shape just outside the mouth of narrow valleys; and as it has been eaten into by the sea it forms bluffs in many places. The bluffs are not by any means always made up wholly of the alluvium, but often merely capped by it, The height of the top of the bluffs is often pretty uniform for a good distance, but varies in different places from a score of feet to a couple of hundred. Such gently sloping plains at the top of bluffs have been called marine terraces in Yesso, and their materials a terrace deposit; but bluff deposit would perhaps be a better name. True marine (or lake) terraces seem to have been found nowhere on the shore except two or three one above another, near Hakodate, especially at Idzumisawa. If they were caused by different stages of sea level it would be strange not to find similar terraces on other parts of the coast. Possibly therefore the sea between Yesso and Nippon (either in part or wholly) was once a closed basin with the water standing successively at different heights. The rocks that chiefly make up the terraces are much older and firmer than the loose alluvial matter with which they are covered, so that they may have lasted since the time when the outline of the land was so very different; and volcanic action may have hastened the changes.

Volcanic-pebble Rocks.—Much of the western part of this portion of the Island is covered with rocks that are chiefly made up of pebbles of volcanic rocks. Such pudding rocks are found especially in great thickness around Iwanai and along the coast northward around the Shakotan peninsula. The pebbles (sometimes very large, even three feet) are of various kinds and are often

different from the finer sand-like materials in which they sometimes lie embedded, and they are often very much rounded as if by water. These beds of rock have been called "tufa conglomerates," and would seem to be the result of the wearing away of volcanic rocks by water. They have much the same dips as the coal bearing rocks, or even steeper and rest perhaps conformably on them.

Volcanic Rocks.—The volcanoes that still have active sulphur vapours seem to be mostly along the shore of Volcano Bay and the adjoining coast. Beginning at the north there are Tarumai, Nuburibets, Usu, Komangadake, Esan; and besides there is Iwaonobori near Iwanai on the west coast. Of these, Tarumai had a small eruption about the first of March (20th of 1st month) 1867, and a large one seventy years before, both of pumice; and Komangadake one on the 23rd September (26th of 8th month) 1856, also of pumice; the only pumice volcanoes met with, and the only ones that have been active within historic times. They are about 55 miles apart. Besides these partially active volcanoes, are many more that seem to have long been quite extinct. The highest, most symmetrical and beautiful of them all, is Shiribets Mountain, perhaps 6,000 feet high above the sea, and almost a regular cone. It stands fifteen miles (six ri) south-east of Iwanai, half-way between the two coasts; either one of which has here for some distance a nearly circular outline, with that mountain for the centre. Possibly old eruptions of the volcano may have had an influence on the position and outline of these parts of the coasts, though it is not obvious upon a cursory examination of the rocks and topographical details. A large part of the rocks of the southern end of the Island, say from Sapporo southward, are volcanic, oftenest porphyritic in structure and several old ruined

craters apparently are still to be seen, as for example one on Hakodate Mountain.

Toshibets Karafto System.—At the Toshibets gold field and further southward, are rocks with dips from 50° to 25°, or even less with axes bearing north five degrees east (magnetic) or thereabouts. These rocks contain on the Toshibets, and at Yurap mines, Idzumisawa and elsewhere great numbers of the fossil tubes of the tube-worm; and in other places there are very modern-looking shells that seem to belong to the same group of rocks, which are moreover mostly soft and very new looking. Also, in rocks of that group at Tomigawa, across the harbor from Hakodate, are two or three thin beds of earthy brown compact lignite, much newer looking than the Kayanoma and Horumui coals, though much older than the lignite found in various places in the alluvium. This folding may conveniently be called the Toshibets Karafto System; for the sections of the Toshibets survey will probably show the rocks folded by this system more fully than any other. Mr. Munroe thinks that they have there a thickness of three thousand feet, with reddish brown soft sand rock at the bottom, but above, almost wholly greenish gray soft clayey sand rocks or sandy clays with some balls of limestone near the bottom, and here and there in other places bands of pebble rock. This description, except the red rocks at bottom, answers closely also for the rocks of Idzumisawa.

Coal Bearing Rocks.—The productive brown coal measures both at Kayanoma and on the Horumui have axes running about north fifty degrees east (magnetic), with dips of thirty degrees to sixty degrees, steep on the north-west side at Kayanoma, and on the south-east side on the Horumui; and seems to be of comparatively recent age, perhaps tertiary, from the appearance of fossil leaves in the shales. A number of fossil shells

found in the Horumui field will perhaps determine the age more exactly. The coal very much resembles the coal of the Rocky Mountains, of about the end of the cretaceous and beginning of the tertiary. At Kayanoma, the coal-bearing rocks seem at the edges of the field to be overlain by the volcanic-pebble rocks; the underlying rocks have not been seen. In the Horumui field, the coal measures seem to be underlain by rocks of the Horumui Karafto System of folding. The coal rocks o fthe Kayanoma field are mostly light gray shales, with but one exposure of limestone, a three foot bed. In the Horumui field the rocks are mostly blue gray shales having in certain parts balls of limestone with fossil shells; but no bed of limestone was found here. The close parallelism of the axes of the coal rocks to the trend of the Kuril Islands seems to justify the convenient name of Horumui Kuril System for the folds.

Horumui Karafto System.—The rocks just mentioned as seeming to underly the Horumui coal have a nearly vertical dip and a strike of north three degrees or five degrees east (magnetic). They are at least six hundred feet thick, and are bluish grey shales and pebble rocks, coarse and fine, all much older-looking than the coal rocks, as if somewhat metamorphosed: The pebbles of the pudding rocks are of granitic, syenitic, or other ancient crystalline rocks, such as are not seen at all in the overlying beds. No fossils have yet been found in these older nearly vertical beds. The close parallelism of their strike to the general trend of the Island of Sagalin (Karafto) and of the northern part of Nippon is very noticeable, and seems to justify giving to such rock folds the name of the Horumui Karafto System.

Near the Tomigawa lignite of the Toshibets Karafto System is the Garonosawa limestone, a much older looking rock, much broken up by cleavage planes and

apparently much metamorphosed. It would seem, therefore, to be of nearly like age with the vertical rocks of the Horumui; while the more recent looking rocks near it of similar strike would seem to be newer than the brown coal measures, and to have been folded by a later action than that of the Horumui Karafto system, though nearly or quite in the same direction.

Toshibets Kuril System.—On the Toshibets Mr. Munroe found in places ancient looking syenite, generally quite soft, which had a strike nearly north-east and south-west with nearly vertical dips. Pebbles of similar granitic rocks are found on the headwaters of Kunnui River and perhaps elsewhere. If, these be really (as they seem), older than the rocks of the Horumui Karafto System, to which they probably furnished the crystalline pebbles, the folding of the rocks of the island would seem to have been twice alternately about north-east and about northerly in direction, and the folding of these crystalline rocks may be said to belong to the Toshibets Kuril System.

Of course the same system of folds might affect rocks of very different age; but no more precise determination of the relative age of the rocks has yet been made. Still, the thickness of the rocks belonging to each system is not very great, and each group has throughout an appearance so uniform that there is probably no very great difference in the age of their different parts.

The useful minerals of chief importance in the field gone over this year are:—Coal, iron-sand, sulphur, limestone, gold, rock tar and mineral springs; and traces of silver, lead, zinc, manganese and copper.

Coal.—The *Kayanoma Coal Field* is about seven miles (three ri) north of Iwanai, and one mile and a half (half a ri) from the sea-shore, and covers half a square mile or so (say 400,000 tsubo). The beds of rock lie in

the form of a saddle running nearly north, fifty degrees east (magnetic), the axis passing through the Shibui valley. The coal at the present mines dips steeply (fifty degrees), but in other parts of the field the coal beds dip only thirty degrees or even ten degrees. The coal rocks seem to be limited on all sides by overlying beds of volcanic-pebble rock made up of volcanic materials; the underlying rocks seem not to be exposed.

There are six workable coal beds from three feet to eight feet in thickness. The coal is what is strictly called brown coal, probably of tertiary age, though closely resembling bituminous coal in its appearance and in many of its qualities. The coal of one of the old mines, abandoned on account of its greater distance from the sea shore, cokes in the fire; none that has been tried at other points cokes. The quality of some of the beds is very fair, although assays made last winter show from $6\frac{2}{3}$ per cent. to 9 per cent. of ashes, and consumers complain of it in this respect. The mining has, however, been so poorly managed that slate is no doubt needlessly mixed with the coal. The whole field contains perhaps a million and a half of tons of coal above its lowest natural drainage level, and as much more for every hundred feet in depth below that.

The present mines are about two miles (28 cho) from the sea shore at the present shipping place at Kayanoma. Vessels there are very much exposed to the weather on a dangerous rocky shore; and special attention was given to the question of shipping the coal elsewhere. Our maps will probably show the possibility of building a tramway, with ease and without tunnelling, from the neighbourhood of the present mines to the Shibui harbor close to Chatsunai—less than two miles distant in a straight line. Such a road would start from the lowest natural drainage level of the bed now mined, much lower than the present mines

and near the foot of the second inclined plane, and doing away with the third also would, with a very gentle down grade, pass along the hill side and over the lowest gap in it, and then descend more rapidly to the shipping place. If the last descent should prove so steep as to require a plane, it could perhaps be so arranged that the loaded cars should draw the empty ones to a little greater height than the bottom of the gap, so that they could run all the way down hill to the mines again. Coal has also been opened at several points in the Chatsunai valley itself, about two miles from the harbor, and one of the beds has about 8 feet of coal and dips but thirty degrees. A tramway could easily be built, with a gentle down grade, from this coal all the way to the harbor.

The harbor at Chatsunai is, however, very small though well protected, and the deep water of Shibui harbor close adjoining is still smaller in extent. But a break-water 375 feet long, in water at most 25 feet deep, built from the northern head of Shibui harbor to the north end of an outlying ledge of rocks ; and some 250 feet more to connect this ledge with other smaller ones in line with it, would make a land-locked harbor of about six acres of water twenty-five feet or more deep, and give protection to about ten acres of like depth from all quarters except about thirty degrees (west to south-west by west), and to much more from the north-westerly storms of winter. It seems an unusually good place for making an artificial harbor. The break-water would be not only in shallow water, but very short in comparison with the surface protected. The stone for building would be in the cliffs at the very starting point of the break-water ; the entrance to the harbor would be wide, deep and easy ; and the only streams emptying into the harbor are two small brooks which could not silt it up. On the other hand, the Iwanai poorly sheltered harbour is

the next best resource, and it is five miles distant from the coal and separated from it by the Horikap River and the hill next to it. To the foot of this hill, however, the country is flat, and a tunnel of perhaps only a thousand feet would reach a thick bed in the Chatsunai valley from the Horikap side.

The *Horumui Coal Field*, near the head waters of the Horumui and about twenty seven miles (eleven ri) east-northeast of Sapporo, is part of what would seem to be a very large field. Our survey this year went over a portion of it only, about three miles (1½ ri) long by half a mile (seven cho) wide: because that seemed enough to show what part of the field was nearest to the navigable water of the Ishcari, and whether it would be best to open mines there soon. The surveyed coal lies about a dozen miles (five ri) in a straight line from the Ishcari river, and is separated from it chiefly by a level plain. We did not see the north-eastern end of the field. Indeed information was given, some months after our departure, that coal was known to exist on the Sorachi river, some twenty-five miles (ten ri) to the north-east, almost certainly a continuation of the same field, since the general strike of the coal is about north fifty degrees east (magnetic). Coal is also said to be found on the south side of the mountains between the Horumui and the East Coast, and quite likely it belongs also to the same field. In that case there would seem to be an extent of some thirty miles (twelve ri) in length by perhaps as much in breadth.

In the portion we traversed, we found the beds to lie in the form of a saddle running (as at Kayanoma) about north fifty degrees east (magnetic); with a steep dip of some sixty degrees on the south-east side, and a gentler one of say forty-five degrees on the north-west side. No rocks are exposed above the coal-bearing rocks within

the limits of this year's surveying; but the underlying rocks apparently are exposed in many of the neighboring streams and are chiefly grey shales, 600 feet thick at least it would seem, and some brown pebble rocks with pebbles of old crystalline metamorphic or possibly eruptive rocks. The dip of these underlying beds is very steep, eighty-five degrees east, magnetic), closely parallel to the general course of Sagalin (Karafto) and of the greater part of Nippon.

The whole number of workable coal beds seems to be six, with different thicknesses, from three feet to five feet. The coal is (like that of Kayanoma) a brightly shining brown coal, probably of tertiary age, very closely like good bituminous coal in appearance. A sample assayed by Mr. Munroe last winter, said to come from here, contained

Moisture.....	3.8	
Volatile matter.....	39.5	
Fixed carbon.....	52.4	Coke (friable and
Ash (fawn color).....	4.3	dull) 56. 7.
	100.0	

We have now taken a number of samples from each one of the six beds, and they will be assayed this winter. The coal is much firmer than that of Kayanoma, and will therefore bear rough handling and distant transportation better than that does. In the portion of the coal that we went over there would seem to be perhaps ten millions of tons of coal above the natural drainage level. The hills are high (some five hundred feet) and the larger valleys are wide enough for mines to be opened near the points where the outcrops of the several beds cross the streams.

It is a dozen miles (five ri) to the nearest water navigable for large boats (the Ishcari river), and

the country between seems to be wholly a flat plain, mostly covered with heavy (but rather open) timber, with here and there treeless prairies, and sometimes swamps. From the nearest point of the Ishcari the distance by river to the sea is about 30 miles (12 ri), and the water is said to have been found, by Lieut. Day's survey this season, to be deep enough for vessels drawing fourteen feet, except on the bar at the mouth, where for a short space there are but twelve feet at low tide. In another direction a railroad might be built, over almost wholly level ground, to the excellent harbor of Mororan, about eighty miles (thirty two ri) distant. Unquestionably the amount of coal in the field would enable the shipment of coal enough to repay amply the cost of such a road.

The traces of coal at *Kudow,* though of no economic value, (three beds from two to fourteen tenths of a foot thick) were yet found by Mr. Munroe to be interesting, from the fact that the rocks there had a strike of about north fifty degrees east, like the coal rocks of Kayanoma and the Horumui.

Iron Sand.—The only ore of iron that has yet been found in any quantity in Yesso is magnetic iron sand. It is most abundant on the south shore of Volcano Bay, especially near Yamukushinai. It is also found in some quantity near Kobui, on the eastern end of the peninsula east of Hakodate. Though these two are the only workable places yet found, the magnetic iron ore is also found in some quantity on many a beach, and in the sands of many a river bed. Indeed, traces of it, at least, are found in almost every deposit of sand, even though not noticeable to the naked eye before separation by a magnet. It is sprinkled through many of the wide-spread volcanic rocks of the island, and, from the wearing away of these rocks, their reduction to sand and concentration of the

heavier ore by the washing of the tides and waves or rivers the sand ore deposits are due.

The iron sand deposit on the shore from *Yurap to Otoshibe*, and perhaps a little beyond at either end, is, say, ten miles (four ri) or 17,600 yards (8,800 ken) long, by twenty yards (ten ken) wide on the average, and perhaps half a foot thick on the average; making in all, 58,667 cubic yards (7,333 cubic ken). The ore looks very rich in many parts, but is generally mixed with a notable amount of other sand. If it would average eighty per-cent. of pure ore there would be about 120,000 tons of it, which would contain 87,000 tons of iron. The ore seems to contain a certain amount of titanium; for, at the old forge near Okotsunai, the ore was found hard to work alone, and was mixed with half its quantity of Kobui ore to make it more fusible. The old iron works of Okotsunai, half a mile from the sea shore, and a mile and a-half (half a ri) from Yamukushinai, were first built some ten years ago, worked a couple of years, were idle a year and a-half, worked again four or five years, and were finally abandoned three years ago, and are now in ruins. There were two bloomary forges, with large bellows worked by a water-wheel. The furnaces were worked only in the summer half of the year. Eight workmen were employed daily in two shifts, four in each; and 5,800 lbs. (700 kamme), it is said, were made in three days, that is 1,933 lbs. in one day (perhaps in some exceptional case only). The amount of charcoal burned was three and a-half times the weight of iron produced, they say, and costs now one quarter of a cent a pound (twelve and a-half sen for six kamme); formerly it was a little cheaper. For the mere washing of the ore there is plenty of water in the small streams that cross the iron sand and empty into the sea at every little distance. The same streams would float down wood for charcoal to be used in smelt-

ing ; and the supply from the Yurap valley would be very large. Besides the iron sand reckoned in the estimate just given, there is a very large amount of poorer sand, either in underlying layers or in neighboring places, and with cheap labor it is quite possible that more ore could be washed.

At *Kobui village* on the sea shore, twenty-seven miles (eleven ri) easterly from Hakodate, is a deposit of easily smelted iron sand. At the thickest point it is about two feet thick, but thins out to a knife edge in all directions from that. The whole length of the deposit is about six hundred yards, almost all (say five sixths) of it either very thin (one tenth of a foot) or comparatively poor. There are perhaps in all 250 cubic yards (thirty one cubic ken) of sand, containing perhaps two hundred cubic yards, or, say, four hundred tons, of pure ore, which would hold 290 tons of iron.

About a mile (half a ri) *south westerly from Kobui village* is some more rich sand, at the mouth of the Otsuki river. Ore was taken here and at the village for the blast furnace whose ruins now stand half a mile (ten cho) inland on the Musagawa ; but smelting the ore was abandoned within the first year, fifteen years ago. About ten years ago a single boat-load, it is said, of ten koku (perhaps one ton and two-thirds) of sand, was sent from the mouth of the Otsuki river to the iron works near Yamukushinai, to be mixed with the ore there as already mentioned. No other working of the sand has been done. The rich part of the deposit is about thirty yards (fifteen ken) in diameter, with a thickness of two feet and eight-tenths at the centre ; and contains, perhaps, 700 cubic yards of sand of which, perhaps, 500 yards, or 1,000 tons would be pure ore, containing 725 tons of iron. From this place for four hundred yards or so towards Kobui is poorer sand, formerly thought too poor to work,

some twenty yards wide and perhaps a foot thick on the average. making in all 3,667 cubic yards ; containing perhaps 2,000 cubic yards, or 4,000 tons, of pure ore, holding 2,900 tons of iron. That would make in all, at Otsuki, 5,000 tons of ore, containing 3,650 tons of iron. But these estimates of the richness of the sand at all places are mere guesses from looking at it, as no assays have yet been made of the samples taken. No more solid bed of such ore is known in this region.

At *Shirikishinai* on the sea shore, near Kobui, and twenty-five miles (ten ri) from Hakodate, is a small bed of iron sand, say a hundred yards long by twenty-five yards wide, and said to be one foot and three-tenths thick at the thickest place, and containing therefore some 100 cubic yards. The sand does not look very rich, and holds perhaps in all 140 tons of iron. The sand was worked seventeen years ago, and during three years after that for a furnace on the Menokonai river near by, at two miles (thirty cho) from the mouth. The furnace is said to have been oblong square in form, seven feet long by four wide and five feet high, and built of clay ; and to have been of the kind used in Nambu, the neighboring province of Nippon. The iron, they say, was soft and pretty good, though not the best ; and the working was abandoned from the smallness of the quantity of ore.

No vein of solid ore has yet been found anywhere, and most likely there is none. In one case, however, in a gully on the side of the volcano *Komangadake*, a layer of magnetic iron sand a foot thick was found, regularly bedded with the other volcanic rocks, and about seven feet and a half from the surface of the hill. It is 1150 feet above the sea, and two miles and a-half (one ri) distant from it. It seems to be exposed nowhere else, and its extent and persistence in thickness is quite unknowu. Above it is only loose pumice, which would need to be stripped off in case

the ore were worked. Perhaps it may at some future time be thought worth working and can then be explored by digging, but at present it does not seem worth while.

The whole amount, then, of pure ore in the principal workable deposits is perhaps 125,500 tons, containing 91,000 tons of iron. Only 5,500 tons of the ore (containing 4,000 tons of iron) are of the easily smelted kind.

Sulphur.—The Sulphur occurs mostly within the craters of now inactive volcanoes. Hot sulphur fumes rise through small crevices and deposit yellow sulphur on the cold surface of the ground, forming a crust more or less impure, with a mixture of partially decomposed rocks. The shape of such deposits is extremely irregular and often rather inaccessible in many parts; so that the precise extent can hardly be measured except very roughly. At the place at Esan (the only mines worked at present) some four-tenths of the surface over which the deposit is scattered seemed to be covered with sulphur earth. The thickness of the sulphur layer there is about half a foot, but the lower part is so very impure that only one-twentieth to one-fifth of a foot, perhaps one-tenth on the average, is at present thought worth gathering. This gathered impure mixture yields, it is said, four-tenths of its weight in sulphur. If this be taken as a guide in estimating the quantity at the different places, there would be at Esan (guessing roughly) 400 koku, or about sixty-three tons of sulphur, to be won, but the workmen there estimate the amount at less than one-fourth of that, owing perhaps in part to its having been worked out in places, since the working has been going on for a dozen years on a small scale. There may perhaps be thirty tons (or nearly 200 koku) left.

The *Esan* sulphur is on the northern side of the crater of a volcano long inactive, and on the close adjoining slope of the mountain just outside the crater. The elevation

above the sea is from 1,250 to 1,550 feet; and by road the distance is about a mile and a-half (a long half ri). In the middle of the plain, half a mile in diameter, that now fills the old crater, stand the small sulphur works, where for a dozen years in the summer months the sulphur earth has been purified by melting. It is melted three times over in three large pots two feet in diameter and three in depth. The stones and dirt most sink to the bottom of the pots and are separated so; but the sulphur after the last melting is strained through thick canvas. Five men do the whole work of gathering the sulphur, bringing it to the furnaces, tending the melting, and packing the sulphur in the bags to be carried to the sea-shore at Netanai. One hundred koku, or about sixteen tons, of sulphur are made in three months, at the following cost, according to the workmen:—

	Yen.	*Yen.*
Wages of five men, at $10, ...		50.00
Food for five men, for three months:		
Rice, ...	16.87½	
Miso, ...	9.00	
Soy, ...	5.62½	
Salt, ...	0.56¼	
Pickles, ...	4.50	
		36.56¼
Iron pots, ...		189.00
Wood fuel, 75 cords of 125 ft. @ 1.06¼		76.93¾
Cotton bags, ...		53.12½
Picks, hoes, hammers, skimmers and other tools,		33.87½
Kegs for moulds, ...		18.75
Mats and ropes for carrying sulphur earth, ...		10.87½
„ „ „ „ to Netanai,		28.75
Horses hire for carrying sulphur, ...		15.37½
		513.25
Carriage of sulphur to Hakodate, ...		25.00
		538.25

As the price of sulphur at Hakodate is said to be from

three hundred to three hundred and fifty dollars (yen) for 100 koku, it is possible that there is some mistake in the statement just given; but it is also possible that the sulphur is manufactured at a decided loss. Since the wood costs at Netanai only eighty-seven and a-half cents (sen) for one cord, the saving in respect to it, if the furnaces were on the shore, would just about equal the additional expense of bringing down there the impurities of the sulphur earth, and there would besides be many advantages in having the furnaces there. Horses could go all the way from the sea to the mines. The great expense for kettles would be reduced one-half by working at night also, instead of merely keeping the sulphur liquid in the kettles as at present. Although sulphur is so valuable and rare a mineral, no royalty is taken for it; in order, it is said, to encourage its manufacture.

The sulphur on the top of *Tarumai volcano* about nine miles ($3\frac{3}{4}$ ri) from Tarumai village on the sea shore, is wholly within the inner crater, of about 400 yards in diameter and 250 feet below the edge of the outer crater lip, which is about 3,000 feet above the sea. The sulphur appears to be in two deposits only, one of them in crescent shape about four hundred yards long by twenty yards wide, the other about thirty yards long by twenty yards wide; making in all, then, a surface of 8,600 square yards. Reckoning the same average thickness of workable sulphur earth as at Esan, there would be about thirty-five tons (or over 200 koku) of sulphur to be won here. The very abundant fumes here, as at Esan, must be constantly adding to the deposit, but how rapidly there is at present no means of judging. The present deposits, however, have probably accumulated since the last eruption, a small one about seven years ago. The sulphur was formerly worked for three years, but abandoned thirteen years ago. The ruins of the furnaces with places

for at least five pots are still to be seen about two miles (twenty-seven cho) below the mines. Horses could go all the way to the mines from the sea.

The sulphur on the top of *Iwaonobori* is about fourteen miles (5½ ri) from the sea at Iwanai, and about 3,500 to 3,800 feet above the sea. The sulphur deposits cover perhaps twenty thousand square yards, and would contain, by the same reckoning as at Esan, perhaps seventy-five tons (or 150 koku) of sulphur to be won. The ruins of the old sulphur works, abandoned five years ago after many years of work, are just below the mines and seem to have been larger than those at Tarumai. The road to them from Iwanai is passable for horses and even beyond that as far as the mines, but the last two or three ri are at present very bad, though a good road for horses could be built without any great difficulty. If the Shiribets valley, as it deserves, should be opened up by a wagon road from Isoya, the distance to the road from the sulphur mines would be perhaps only a couple of miles (or a ri). The sulphur fumes are less abundant here than at Esan and Tarumai.

The *Nuburibets* sulphur is found in a small valley close by the Nuburibets hot-springs, about nine hundred feet above the sea, and at about four miles from the sea shore at a point seventeen miles (seven ri) from Mororan by the new road. The sulphur place hardly seems to be an old crater, though possibly it may be so. Abundant sulphur fumes however rise from the rocks, and other appearances are the same as in volcano craters. The extent of the deposits is, at a rough guess, fifty thousand square yards, containing by the same way of reckoning as at Esan some one hundred tons (600 koku) of sulphur. The working of sulphur here was abandoned some sixteen years ago; there seem to have been but three melting pots.

The *Oi Lake* sulphur is on the banks of that lake of hot and boiling water, about a quarter of a mile (4 cho) from the Nuburibets sulphur. The lake is apparently within an old crater. The sulphur covers perhaps 8,600 square yards, and would in that case be capable of yielding, according to the Esan reckoning, thirty-five tons (or over two hundred koku). A horse path or wagon road could probably be easily made from the lake all the way down the valley of its outlet to the Nuburibets hot-springs, and so to the sea-shore.

The *Kobui* sulphur is partly at the old sulphur works on the Musu River, at four or five miles (a ri and a half, or two ri) from Kobui village near the mouth of that river on the sea-shore, and partly at a place discovered this year on a branch of the same stream about a mile to the north-west. The sulphur is a bedded deposit from sulphur water and seems to be very pure, but is of a gray color quite unlike the yellow sulphur of all the other places. The deposit at both places is extremely irregular. The old mine is a drift called 240 yards (two cho) long, which is said to have followed a vein one foot thick which contained yellow sulphur (without any gray) in small nests and single crystals, but gradually grew poorer to the end. Outside near the mouth of the mine is a bed of gray sulphur about two feet thick, dipping 35° north 80° east, and is exposed for a length of about four yards. Also, at the mouth of the mine is a thickness of four feet of grey sulphur, which the former worker of the mine however insists does not extend to the interior. Still it was not much sought after, as, on melting some of it a dozen years ago and sending it to Hakodate, it could not be sold, it is said, on account of its color. Nevertheless, the bed having been deposited probably in a stream or pool of sulphur water, is not likely to be very uniform in thickness nor very wide spread. The same may be said

of the newly discovered gray sulphur a mile to the northwest, which, however, is exposed for a space of a hundred feet in length, in the bank of a small ravine, and some four yards in height, partly very pure, partly mixed with earthy impurities. Perhaps one-third of the whole is pure sulphur. It might perhaps be well enough to count upon two hundred tons of sulphur here in all, and twenty-five tons at the old mines; but the quantity may prove to be far greater.

The whole quantity of sulphur to be got from the places visited this year would seem, then, to be possibly five hundred tons (three thousand koku). The completion of our maps may bring about very important changes in these estimates.

Limestone.—The principal exposure of limestone is on the small stream Garonosawa, about five miles from Arikawa and Sekirichi, which are seven miles (three ri) across the bay from Hakodate. The limestone is exposed in cliffs on the hills either side of the brook to a height of perhaps six hundred feet, for a distance of some four miles. The amount, then, within one yard of the surface would be (very roughly) some eight million cubic yards, or twenty million tons. As the whole depth is probably many yards, perhaps hundreds of yards, that quantity is very little compared with what may be expected to exist within the hills, and may be safely considered as inexhaustible for a thousand years. Of that amount perhaps twelve thousand cubic yards, or thirty thousand tons, are already in loose blocks in the bed of the brook. The quality seems to be very good indeed, say, one-half dark blue limestone, the other half light gray. It all seems very much metamorphosed, in some small parts even like marble; and no fossils could be found. The cleavage planes are very strongly marked and often obscure the dip; but at least one saddle in the rocks (anticlinal) is

to be clearly seen, with a course of north five degrees east (magnetic) sinking five degrees in the opposite direction, south five degrees west, the bearing of the Horumui Karafto System of axes. A wagon road or a railroad could easily be built with down grade all the way about four miles to the sea shore. Wood at the limestone costs two dollars a Japanese cord (125 feet).

On the sea-shore at the western end of the village of *Ishizaki*, ten miles (four ri) east of Hakodate, begins an exposure of gray and white pure looking lime rock about 250 yards long in cliffs on the side of a bluff eighty-five feet high. The whole amount "in sight" may perhaps be 2,000 cubic yards or 5,000 tons. No doubt a far larger amount exists behind what is in sight; namely 15,000 cubic yards or 40,000 tons for every six feet (one ken) back from the face of the bluff, or in 100 yards, 750,000 cubic yards, or 2,250,000 tons.

The *Kamiyunosawa* limestone about five miles (two ri) north-east of Hakodate, is exposed on both sides of a very small valley here and there for a space of a quarter of a mile. Some 800 cubic yards or 2,000 tons (very roughly speaking) seem to be exposed. The quality is good; and a kiln is in use here since last year for burning the stone to make lime. The kiln is thirteen feet high by six feet in diameter, cylindrical; and, it is said, burns 1,750 lbs. (210 kamme) of lime at a time during three days, and burns twice and a-half in the month or 4,325 lbs. (525 kamme), about two tons in all. Nine Japanese cords (of 125 feet) of wood, at $1.45 a cord are burned each time—that is $18.60 for a ton of lime. The carriage of one horse load of 218⅓ lbs. of lime to Hakodate is $0.115, or $1.20 a ton. Laborers' wages are $0.25 a day. The lime at Hakodate brings $7.10 a ton (or 37½ sen for one *hio* of four *to* or 13,100 *me*) A wagon road to Hakodate could be made with very

great ease, as it would be almost wholly over nearly level ground free from rocks and trees.

About a mile (twelve cho) north-westward from *Washinoki* on the sea-shore some gray limestone is exposed that looks rather impure with clay, but on burning may make strong lime. The exposure is at the axis of a basin (synclinal) with a dip of sixty degrees on one side, and one of eighty-five degrees east on the other; and belongs therefore probably to the Toshibets Karafto System of rock folding. The thickness of the limestone is about four yards in all, besides some accompanying gray clay shales, perhaps limy also. Supposing it extends only a quarter of a mile ($3\frac{2}{3}$ cho) inland, and to have an average height of thirty feet from the sea level up to the surface of the ground, the whole amount would be 17,500 cubic yards or 4,300 tons; enough to supply such a kiln as that of Kamiyunosawa at the present rate for about a thousand years. Single blocks or large balls of limestone are also found on the Washinoki river about a mile above the main oil spring, and may come from the same beds as those just mentioned as exposed on the sea shore. It is also not unlikely that these beds may be found in places farther up stream as their bearing from the sea shore would seem to bring them there.

In like manner, balls of limestone are found in some numbers near the Horumui coal beds; but none are in place except small ones imbedded in the thick beds of shales that accompany the coal. It is probable, therefore, that the balls come wholly from such a source, and that there is no bed of lime rock.

Gold.—The chief gold field surveyed this season is that of the *Toshibets*. The gold occurs in the form of small grains and scales in the alluvial gravel that borders the river. The bed rocks are of the Toshibets Karafto System, chiefly soft sand and clay rocks. No gold-bearing quartz

vein has yet been discovered, but the grains of gold seem to be somewhat larger in the upper part of the field. The gold-bearing alluvium of Mr. Munroe's survey he found to extend half a dozen miles along the river (four miles and a-half in a straight line), and to cover in all a space of some three square miles and six-tenths, with a thickness of some six to twelve feet; in some places 25 to 30 feet covered by five or ten feet of barren yellow sand. The richness seems to him to be perhaps four, possibly five, cents, to the cubic yard; but he has not yet had a chance to weigh the gold he washed from measured quantities of gravel. That would give for the whole amount of gold within the field surveyed, say a million and a-half of dollars worth. But one-half or more of the field seems to have been worked over in old times, and is consequently still poorer; and that would bring down the amount of gold to a million dollars or even less. Of course the cost of washing the gold should be subtracted from that in estimating its value. The streams seem to furnish ample amounts of water at sufficient height for washing the whole by the hydraulic method, without very long flumes. It is hardly probable, however, that so poor and small a field would pay for working on a large scale. Washing by hand, as hitherto practised, yields about twenty cents a day to each laborer, rather scanty wages for Yesso. The survey was not pushed to the very uppermost (northernmost) limit of the field, and it is possible that a small extent of somewhat richer ground may be found there, since the grains are slightly larger in that direction. But that part of the valley is narrow and must be quite short. The working of this field has been abandoned for about eleven years.

Near *Kudow* Mr. Munroe found about a third of a square mile of gold-bearing earth four to eight feet thick, poorer than that of the Toshibets and resting on marlite,

volcanic and metamorphic rocks. The whole value of the gold within the field would be then only some eighty thousand dollars, and probably quite too much scattered to work at all.

Near *Esashi* he found on the Jimikishi river about one-fifth of a square mile of gold-bearing earth three to eight feet thick; with perhaps four to five cents worth of gold to the cubic yard. The bed-rock was of mica schist and other metamorphic rocks. There were some quartz veins which perhaps furnish the gold; though no gold was found in them. The whole amount of gold on this river would seem then to be some sixty thousand dollars worth; so much scattered, however, as scarcely to pay for working.

On other rivers near Esashi, the Meniu, Todo, Gokatte, Asubu, Otobe and other small streams, he found some four to five square miles of the gold bearing earth, three to twelve feet thick, poorer than that of the Jimikishi, except the headwaters of the Asabu and Otobe, which may prove equal to Jimikishi but no better. The whole amount of gold then would seem to be perhaps a million and a-quarter of dollars. All the streams for the fifteen miles (six ri) and more, along the coast here, yield more or less gold.

The amount of gold, then, in all the fields surveyed would seem to be less than two millions and a-half of dollars; and in none of them to be abundant enough to give much encouragement to working.

Rock Tar.—The so-called oil of Washinoki, Yamukushinai and Idzumisawa is all black, and so very thick as to deserve better the name of tar. At Idzumisawa it comes clearly from the soft bluish gray somewhat shaly sand rock, that in its dip belongs to the Toshibets Karafto System, and has the some fossils as the Toshibets and Yurap rocks. Some at least of the Washinoki tar comes

from rocks with a similar system of dips ; the rest comes from alluvial gravel in which it has perhaps accumulated after oozing out of such rocks below. At Yamukushinai it comes only from alluvial gravel, but has perhaps entered it from rocks below of like age with those of Idzumisawa. All the oil would seem then to be possibly of the same age and it very likely is so ; and that age seems to be comparatively recent, perhaps tertiary.

The *Washinoki* oil springs all occur within two thousand feet up and down the Washinoki river and within a mile or so (one half ri) from the sea. The main well is a somewhat triangular hole dug last year, about ten feet long by five wide and half a foot deep. Within the past year about four gallons accumulated here. The next day after gathering that amount about two gallons more were taken ; it was of the specific gravity marked by fifteen degrees of Beaumé's scale. Another well dug last year and re-opened this year is about a quarter of a mile below the main well and is a shallow hole about two feet and a-half in diameter. About eleven quarts (seven sho) were taken here as the past year's accumulation ; and within the next following day a pint and a-half accumulated, which marked twelve degrees and a-half of Beaumé. The oil seems to come wholly from deposits of small extent ; and though in some cases seeming to come from the alluvial gravel, it probably at the outset came from the soft greenish gray sandrock from which it seems to come at the two wells just mentioned. That rock dips from thirty-five to seventy degrees at different places, so that its outcrop crosses the country far and wide. Yet the oil springs are confined within a narrow space, and would seem therefore to belong to but a small portion of the oil-bearing beds of rock. It is not likely then that a large yield of oil can ever be got here ; and as with so steep a dip the depth and consequent cost of wells would

very rapidly increase according to the distance from the outcrop at which they are bored, the encouragement to such undertakings, in view of the small yield of the present wells, is not very great.

The oil at *Yamukushinai* is found wholly within the village in the alluvial gravel of a plain 150 yards (75 ken) wide, that borders the sea shore. The main well, dug last year, is a hole some ten feet square and eight feet deep, loosely walled at the sides with wood. About twenty-four gallons were taken here as the accumulation of the past year; and in the next day a little over three pints (about one sho) collected there, which was so thick as to have specific gravity of eleven degrees of Beaumé's scale. Another well, somewhat smaller, dug by a merchant at about seventy yards (thirty-five ken) southward of the main well, yields only a few drops of oil in the day. One or two other very small holes, one foot or so in diameter, have exposed the same black thick oil in the gravel. But all these exposures are within a diameter of about a hundred yards (fifty ken) except a slight trace at a distance of four hundred yards (200 ken) south of the main well. The deposit then appears to be of very limited extent; for, although the underlying rocks from which the oil probably comes have a dip of twenty-five degrees or so, and an outcrop running doubtless a long distance through the country, there is nowhere else a trace of oil coming from it. There is nothing then to encourage very expensive exploration by boring. Perhaps it may be worth while to gather what oil can be got by digging small inexpensive wells near the main one, and if they turn out profitable, it may some time be good to sink a small bore-hole to a short depth near the main well. The thickness of the oil goes to show that it is a very superficial deposit. Besides the oil here, there are perhaps forty cubic feet of asphalt (dried oil), which would weigh, say, a ton and a half.

The oil at *Idzumisawa* is in a narrow ravine, about a mile from the village, and about half a mile from the sea shore. It is only found at the main well and in mere traces at some other holes within ten yards of that. The main well dug last year is a hole about four yards long by a yard and a-half wide, and two yards and a-half deep, with about four feet of water in it. About eighty-two gallons (two *koku* and one *to*) were taken here as the accumulation of the past year; and in three days afterwards an average of two quarts and two gills and three-quarters (one *sho* and a-half) were taken; which marked eleven degrees Beaumé, it was so remarkably thick. The oil comes almost wholly from one corner, from greenish gray somewhat shaly broken sand-rock, with a dip of some twenty degrees. Although much digging has been done close about here, only traces of oil have been found, and not even so much as that has been noticed at any other part of the necessarily extended outcrops of so steep a bed. It seems therefore highly unwise to undertake the boring of wells along the outcrop, especially very deep ones.

Mineral Springs.—Mineral springs are quite numerous and of varied character in the southern part of Yesso. They have all been visited in passing, with but two or three too distant exceptions; and the main facts in regard to them have been gathered so far as possible without a chemical analysis, and are given in the following table:—

(The heat is given in degrees centigrade; a star means a close approximation; a question mark, a rougher one.)

Name	No	Heat	Character	Rock	Place	Remarks
Oi Lake	1	99°	Sulphur with gas.	Black mud	¼ mile N. W. of Nuburibets Hot Springs.	¼ mile wide. 900 ft. above the sea.
Nuburibets	1-6 7 8 9 10	99° 83° 81° 78½° 48°	Sulphur with gas.	Alluvial earth.	At the Nuburibets sulphur place and close by.	6 or more boiling springs in the sulphur deposit, 900 ft. above the sea, also other cooler ones.
Jôzan	1 2 3 4 5 6	89° 89° 87° 83° 83° 80½°	A little sulphuretted hydrogen.	granitic (volcanic?)	At Jôzan on the Toyohira 17 miles above Sapporo; all within 100 yds.	Nos. 1, 2, 3, 5 and 6 large springs. Some 2 or 3 other springs besides.
Obune	1 2 3 4	78½° 74 73 68	Sulphuretted hydrogen.	Alluvial gravel.	1 ri inland, from Kumodomari and Usudzui	All small, but others still smaller. All within 12 yds.
Isoya	1 2 3 4 5	72° 69 67 67 48	Sulphurretted hydrogen, with gas.	Gray soft clay.	½ ri inland from Isoya, between Shikabe and Kumadomari.	All within about 20 yds. and not large.

Name.	No.	Heat.	Character	Rock.	Place.	Remarks
Nigori-kawa	1 2 3 4	57° 55 51 49	Sulphuretted hydrogen, with gas bubbles, except No. 4	Alluvium.	1½ ri from sea shore, near Ishikura, 2 ri N. W. of Washinoki.	All small, all within 50 yds.; ½ m. & 1 m. towards sea, many small cold sulphur springs.
Esan	1 2 3	53° 50. 45 ?	Very acid and astringent, sulphuretted hydrogen.	Alluvium.	On Esan Mtn, ½ ri from Netanai.	All small and within 20 yds.
Kakumi	1 2 3	50° 47 40 ?	A very little sulphuretted hydrogen, gas bubbles, but none from No. 1.	No. 2 from surface gravel; others, greenish, gray volcanic porphyry.	½ ri inland from Kakumi, all within 100 yds.	All small.
Yunai	1 2 3	49½° 47 46	Sulphuretted hydrogen with gas bubbles.	volcanic, mottled white and bluish gray.	In Raiden Mtn. 3 ri N. W. from Iwanai.	All within 30 yds. Another 30 cho distant cooler.

Name	No.	Heat	Character	Rock	Place	Remarks
Kusuri Lower	1 2 3	45½° cold. cold.	Sulphur and iron with gas.	Alluvium.	200 yds. towards Otoshibe from Kusuri upper springs.	Within a space of 25 yds.
Yudomari	1 2 3 4	33° 32⅛ 29 27½	Sulphur? and copperas with gas.	Pale green gray volcanic porphyry.	At Yudomari "copper vein" near Sakkadzuki.	Water used as an eye-wash.
Kusuri upper	1	35°	Sulphuretted hydrogen with gas bubbles.	River gravel.	3 ri from Otoshibe on Esashi road.	Small.
Notap	1	cold.	Sulpuretted hydrogen.	River gravel.	2 ri from Otoshibe towards Esashi.	Small.
Shikabe	1 2 3 4 5	91° 70½ 70 44 42	A little iron; gas bubbles.	Beach gravel of seashore.	In Shikabe village No. 1 at 200 yds. from the others & below high tide	No. 1 largest, all small, No. 1 probably boiling at little depth.
Yumoto	1 2 3	43? 43* 43*	Iron.	Granite (or syenite?	On Kennichi River 1½ ri from W. coast.	Deposit of travertine (H.S.M.)

Name	No.	Heat	Character	Rock	Place	Remarks
Yuno-sawa	1 2	43? 32*	Iron.	Light greenish argillite? metamorphic.	1 ri from sea on Moshibe-ts near Kudow.	Near so-called copper mines (H.S.M.)
Yurap	1 2	39° 35	Iron, (no gas ?)	Alluvium.	Close to the furnace building.	No. 1 rather large No. 2 small.
Yuno-kawa	1	35°	Iron (carbonate ?) with gas.	Alluvium.	At Yuno-kawa village 6 miles N. E. of Hakodate	Small.
Boro	1 2	33° 27	Iron (carbonate ?) with gas.	Alluvium.	1 ri from Otoshibe towards Esashi.	Small.
Yuno-saki	1	cold	Strongly copperas ? without gas.	Alluvium.	4 cho W. of Washi-noki near sea.	Small. On beach close by, cold springs.
Tomi	1	50?	Nearly pure water.	Alluvium.	1½ ri from Ikusa-kusa, 2 ri from Shi-kabe.	Small.
Kami-yuno-sawa	1	30°	Nearly pure water.	Alluvial gravel.	At Yuno-sawa lime 2 ri N.E. of Hakodate	Pretty large.

Of these twenty-one springs, then, there are thirteen sulphur springs with temperature from coldness up to boiling; six iron springs from 27° to 91°; one cold spring with copperas; and two nearly pure springs 30° and 50° hot.

Hoping that this statement of the probable results of the season's survey may be of some use while you are waiting until they can be worked out more exactly, I have the honour to remain,

Sir,

Your most obedient servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer.

GEOLOGICAL SURVEY OF HOKKAIDO.

YESSO COALS.

A

REPORT

BY

HENRY S. MUNROE, E.M.

ASSISTANT GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI OF HOKKAIDO.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1874.

SHIBA, April 27th, 1874.

General HORACE CAPRON,

Commissioner and Adviser to the Kaitakushi.

SIR,—In compliance with your order of 26th January last, to take possession of the laboratory and assay the coals collected last year in Yesso, I gave my assistant, Mr. Munroe, instructions to make assays and analyses at once; and I have now the honour to send you herewith his very careful and satisfactory report of the results. In view of the great interest of the subject not only in Japan but in foreign countries, I would strongly urge, that the report be printed in English.

The following are rough general sections of the rocks of the Kayanoma and Horumui Coal Fields to show the probable relative position of the different coal beds and the main character of the rocks between. The first column of figures gives the thickness of the coal that is of at least moderately good appearance; the second the thickness of decidedly bad or bony coal, while in the last column the whole thickness of the coal bed is given including the slaty partings.

KAYONOMA :	Coal. Feet.	Bony or bad Coal. Feet.	Whole Thickness. Feet.
Midzunuki (Upper) Coal	**4.00**	—	**4.00**
Chiefly light-brownish gray shaly sand rocks	—	—	32.00
Midzunuki Lower Coal	2.67	0.23	3.15
Chiefly hidden (light brownish gray shaly sand rock)	—	—	17.16
Honshiki Coal (average ?)	**5.75**	—	**6.00**
Light brownish gray shaly sand rock	—	—	64.45
Tateire No. 1 Coal	2.30	—	2.30
Chiefly light brownish gray shaly sand rock	—	—	13.45
Kosawa No. 1, Osawa No. 2, Tateire No. 2 coal	**5.68**	0.85	**6.75**
Chiefly light brownish gray shaly sand rock	—	—	32.90
Kosawa No. 2, and Kosawa No. 3 coal	0.77	0.75	2.10
Chiefly light brown shaly sand rock	—	—	29.70
Kosawa No. 4, Osawa No. 3, Osawa No. 4, Tateire No. 3 Coal	**3.39**	2.25	**6.65**
Chiefly hidden (light brownish gray sandy shales ?)	—	—	49.30
Kosawa No. 5 coal	—	5.10	6.40
Chiefly hidden	—	—	72.00
Osawa No. 5 coal	2.25	0.85	3.30
Chiefly mixed coal and slate, hard black slate and gray soft shales	—	—	14.65
Osawa No. 6 coal	**5.89**	0.70	**9.95**
Chiefly coal and slate mixed and soft brownish gray shales	—	—	9.60
Osawa No. 7 coal	—	2.50	2.50

	Coal. Feet.	Bony or bad Coal. Feet.	Whole Thickness. Feet.
Chiefly hidden (light brownish gray sandy shales ?).....	—	—	26.60
Osawa No. 8 coal	1.90	—	2.10
Hard brownish black sand rock and soft yellow clay	—	—	4.30
Osawa No. 9 *Coal*.....	**6.08**	0.30	**8.00**
Chiefly hidden (gray sandy shales ?)	—	—	75.00 ?
Ogurasawa No. 1 Coal	—	0.50	0.50
Chiefly hidden (gray sandy shales?)	—	—	40.00 ?.
Ogurasawa No. 2 Coal.....	2.60	—	2.60
Chiefly hidden (gray sandy shales ?)	—	—	31.90
Ogarasawa No. 3 *Coal*	**7.40**	2.40	**12.25**
Soft gray shale	—	—	050
			592.50

Besides that:

Onkosawa No. 3 *Coal* (conjectured to be the same as Ogurasawa No. 3,)..... 8.65 1.0 11.55

and the

Furushiki No. 3 *Coal* (also once conjectured to be the the same as Ogurasawa No. 3, but perhaps much higher.)

The whole thickness of workable and at least passably good coal in the Kayanoma field would seem then to be at least thirty-five feet.

HORUMUI.	Coal. Feet.	Bony or bad coal Feet.	Whole Thickness. Feet.
Chiefly greenish gray sandy shales	—	—	310.00
(L 577 fa) Coal.....	0.50 ?	—	0.50 ?
Chiefly greenish gray sandy shales (partly hid)	—	—	17.00

	Coal. Feet.	Bony or Bad coal. Feet.	Whole Thickness. Feet.
Gray sand rock weathering brown	—	—	8.00
(L 576 *i*) *Coal*	**4.20**	0.80	**5.10**
Chiefly bluish gray shales and greenish gray soft sand rock (partly hid)	—	—	120.00
Sand rock	—	—	2.00
(L 579 n) and (L 579 na) Coal	1.00	2.55	4.65
Sandy bluish gray shales	—	—	6.00 ?
Chiefly greenish gray soft sand rock (partly hid)	—	—	114.00
(L 581 qa) Coal	1.40	—	1.40
Chiefly bluish gray shales (partly hid)	—	—	70.00
(L 602 a) Coal	**5.00**	—	**5.00**
Chiefly greenish gray shaly sand rock (partly hid)	—	—	20.00
Brown weathering shales	—	—	2.00
(L 602 ba) Upper Coal	0.40	0.65	2.60
Chiefly blackish coaly shales	—	—	8.05
(L 602 ba) Middle and (L 602 bb) Coal	1.90	—	3.10
Blackish shales	—	—	3.70
(L 602 ba) Lower and (L 602 cb) Coal	**4.95**	0.40	**6.70**
Chiefly gray shales, sandy above	—	—	16.00
(L 602 d) Coal	2.80	—	2.80
Coal shales, black	—	—	0.50
Hidden (gray sandy shales ?)	—	—	13.25
(L 602 ca) Coal, good and firm	**6.90**	—	**8.40**
			751.75

The coal at (L 603 e) assayed seems now likely to be the same as the lower bench of (L 602 c a) with the

thickness perhaps over estimated; though at first supposed to be a lower bed. The coal at (L 603 g) was at first taken to be lower than any of the others, but must be the same as (L 603 e) or a still higher one; it measures four feet thick.

I have the honour to remain,

Sir,

Your most obedient servant,

BENJ. SMITH LYMAN,

Chief Geologist & Mining Engineer.

REPORT ON YESSO COALS.

MUNROE.

Tokei, Japan, April 22nd, 1874.

To Benj. Smith Lyman, Esq.

Chief Geologist of Hokkaido.

Sir :—I have the honor to report the following results of my examination of the coals of Yesso, adding also, for the sake of comparison, a few assays of well known coals from other ports of Japan.

The coals examined may be divided into four classes with regard to the representative value of the samples, as follow :

1st.—Hand specimens, from Japanese and other sources ;

2nd.—Hand specimens, selected with care as average samples ;

3rd.—Average samples, representing a few kilogrammes ;

4th.—Average samples, representing one ton to five hundred tons.

In the first category must be placed the coals, numbered in the following tables 2, 3, 6, 7 & 8, collected at

Kayanoma ; 37, 41, 42, 43, & 44 from the Bussankioku collection ; 38, a specimen furnished by Admiral Enomoto; 36 and 40, a specimen of lignite brought by Mr. Janin. The results obtained from such specimens will usually be rather better than from the average of the coal.

The second class will include coals numbered 26, 27, 28, 29, 30, 32, 33, 35 & 36 ; specimens collected by the Chief Geologist.

The third series, numbers 10, 11, 12, 14, 15, 16, 17, 18, 19, 21, 22, 23 & 25, were samples of two to five kilogrammes, taken in a uniform slice across the bed or bench of coal, omitting only seams of shale or clay. These samples were packed and sent to Yedo in sealed "sake"-tubs. On reaching here the seals covering 10, 11, 12, 14 & 15, were found to be broken, but the coal inside was apparently undisturbed.

The fourth class, average samples, includes numbers 1, 4, 5 & 9. About one-half ton of each of these coals (except 5) was mined in my presence, care being taken to secure the proper proportion of each bench to represent the actual average as when mined on the large scale.

This coal was broken up and the "slate" separated, and sampled carefully by repeated quarterings, on a clean board floor. The average sample resulting from this treatment was packed in a small tub and sealed. Care was taken not to lose sight of the coal throughout the whole operation. The sample of number 5 was taken from a heap of about five hundred tons of coal, mined within the three previous months, and which had been exposed to the weather, uncovered, during that time. An average half ton or more was secured by taking shovelfuls from different parts of the heap, which was sampled as above. These "sake" tubs reached here with unbroken seals.

Pulverization &c. To prepare the coals of the first and second classes for analysis, a small quantity was chipped from different parts of each specimen, and the resulting samples reduced to a fine powder, sifting them through a fine muslin bolting cloth.

The average samples of the third and fourth classes were broken smaller and divided, and one portion of a kilogramme or more pulverized, sifted through a coarse sieve and again sampled. From this a portion of about fifty grammes was taken for analysis, and powdered to pass through a fine bolting cloth.

Assays. The results of the assays are given in the tables. The following is a brief account of the methods employed. Five grammes of each coal was taken, and the

Moisture, column 1 of the table, determined by the loss upon heating to 140° C., in an atmosphere of carbonic acid. The heating was continued until the weight remained constant.

The *Volatile Combustible Matter,* column 2, was determined from the loss sustained by the dry coal upon ignition in a covered porcelain crucible, in a closed muffle. For the first five minutes, or until the volatile matter ceased to come off, the muffle was kept at a low red-heat, and afterwards raised to a bright-red or white-heat for one or two minutes, to expel the last portions of gas.

To extinguish the coke, the experiment was tried of plunging the hot crucibles into an atmosphere of dry carbonic acid gas, and allowing them to cool there before weighing. This plan gave results 1.5 to 2 per cent higher[1] than the ordinary method and was therefore adopted for the majority of the assays.

The weight of the residue after expelling the volatile

1.—A part of this increase may be due to an absorption of carbonic acid by the coke.

matter gives the *Coke*, and the difference between the coke and ash is the *Fixed Carbon*.

The *Ash*, column 4, was obtained by careful incineration of the coke, in uncovered porcelain crucibles, in an open muffle, requiring from two to eight hours ignition.

Column 5, gives the proportion of Fixed Carbon to one of Volatile Combustible Matter. This serves, according to Johnson,[1] as a very reliable index of the heating power of the coal, the best coal having the highest ratio of fixed carbon.

Column 6, gives the color of the ash. These ashes were carefully preserved in small specimen tubes, and compared at the close of the investigation. Arranged in the order of geological succession, there seems to be a regular shading of the colors; the lighter shades belonging to the lower coals, and the darker to the upper. This is more noticeable in the different benches of each seam,[2] than in the case of the whole series; as the upper bench of one bed is usually darker than the lower bench of the next above. In the Horumui coals the shading of colors is quite perfect, forming an unbroken series from the lowest bed to the highest. In the Kayanoma series there are several exceptions to the rule, Furushiki and Onkosawa being marked examples.—The true position of these beds, however, is, I believe, not yet decided.

The colors may also be grouped into two classes: bright pure orange-yellows and orange-reds, and dull, dirty or brownish colors. The former shades belonging to the Horumui and Sorachi Coals, and the latter to those of the Kayanoma field.

1.—W. R. Johnson, Coal Trade of North America. Phila. 1850, p. 98. For a list of the coals arranged according to this ratio, see page 31 of this report.

2.—Kosawa No. 4 seems to be the only exception—the ash of the lower benches being darkest.

Column 8 shows the percentage of ash in the coke, and is calculated from the figures given in columns 4 & 7. In coking the coal is reduced one-third to one-half, while the amount of ash remains the same. Consequently the percentage of ash is greatly increased.

Column 9. External appearance of Coke. A hard, solid, lustrous and porous coke is called "excellent"; one hard, solid, and lustrous, but close grained, "very good"; one again, hard, dense and lustrous, but fragile, is only "good," while one soft, fragile &c., &c. is but "fair" etc.

Column 10. Determined from the weight of water at 15° C., displaced by a known quantity of finely powdered coal. The coal being thoroughly wetted, and the air removed by placing the coal and water under a vacuum for a short time.

Column 11. Weight of one cubic foot of solid coal. Calculated from the specific gravity—taking the weight of one cubic foot of water at 62½ pounds.

Column 12. Space required to stow one ton, of 2240 pounds, of loose and broken coal. This space depends quite as much upon the state of division of the coal; the proportion of slack and of large pieces, as upon the specific gravity; and can hardly be calculated exactly beforehand. Even experimental determinations must be repeated from day to day, upon large quantities of coal, for some time, in order to be of much value. It has been thought better, therefore, to give the space necessary for each coal between limits, than to attempt to form an artificial average. These figures have been calculated from the specific gravity, using constants determined by Johnson.[1]

In the following tables on lines 13, 20, 24, etc. will

1 Walter R. Johnson, Report on American Coals, Washington, page 590—, Table CC, column 5.

found averages of the different beds. These averages have been calculated on the supposition that the coal from each bench enters the mixture in proportion to the thickness of that bench. The slight differences in the specific gravity of the various benches were disregarded as unimportant.

The Horumui Coals were numbered in the course of the laboratory work, to facilitate reference. The numbers correspond to what has since been given me as the order of succession, beginning however with the upper coal.

The Kayanoma Coals are also arranged geologically, the upper coal at the top. The coals from other parts of Japan are arranged geographically, beginning with the northernmost.

KAYANOMA COALS.

From the Province of Shiribetsŭ.

1. *Midzunuki Coal.* Average sample and specimens taken from the four feet bed, at the end of the drainage level, Honshiki mines, Kayanoma. This is a black, lustrous, hard and solid coal, which will bear transportation. Cleavage cubical; streak on white porcelain, black; powder, in thin layers by reflected light, brown.

Easily inflamed, and burns quite rapidly with a long, bright flame, giving but little smoke. Decrepitates and falls to pieces on first ignition, but cements together again, without swelling, and forms a light and porous mass, burning readily. A hot, glowing fire remains after the flame has ceased.

Certain thin layers of the coal seem to melt, swell, and form a soft, pasty and porous mass, which acts as a cement to bind the non-caking portion of the coal together. The coke contains much sulphur, which is readily detected by the smell of sulphurous acid given off in the burning.

Coke, very hard and solid, not very lustrous, but somewhat porous. The large amount of ash will account for the want of lustre. The coal seems to shrink in coking.

Honshiki Coal. The specimens of upper and lower benches were taken from the "Shinshiki" level near the end, and the average sample from "Stope No. 2," Honshiki mines, Kayanoma. Coal black, lustrous, hard and solid; and will bear handling. Cleavage more or less cubical. Streak dark brown, almost black. Powder dark brown.

Easily ignited, decrepitates, and for the most part falls to pieces; the lower bench alone retaining its form. Cements together again after a short time, but

perfectly. Burns slowly with a bright flame of medium length, giving but little smoke.

Ash, light and powdery, containing a little slaty cinder from the lower bench. Coke very hard, solid and lustrous, but not very porous. Coal shrinks in coking.

Tateire Coal. Specimens and average samples taken from the small drift on the second coal cut by the Tateire tunnel, Honshiki mines. Coal black, lustrous, hard and solid; will bear transportation. Middle bench hard, dull and stony. The lower bench breaks into long splint-shaped pieces, while the middle and upper benches have a more cubical cleavage. Streak brown, and powder very dark brown.

Kindles rather slowly, burns rapidly, with a long, bright, hot and smoky flame; the upper bench burning most rapidly and giving the longest flame. Coal cracks and opens in the fire, but does not fall to pieces. After the flame has ceased, the remaining coals make a hot glowing fire, and burn quite completely.

Ash light and powdery, containing a little slaty cinder from the lower bench. Coke soft, friable and dull.

Kosawa No. 4. Samples taken from the outcrop of this coal in the small ravine "Kosawa" near the Honshiki mines. Specimens very badly weathered, the worst of the whole collection in this respect.

Color of coal brown, with an earthy lustre; soft and easily broken to pieces. Lower bench black and crumbly. Cleavage apparently cubical (?) Coal covered with white efflorescence, indicating a large quantity of decomposing pyrite, the action of which may account for the condition of this weathered outcrop. Streak of upper bench quite brown; of the middle and lower bench black. Powder of coal, very dark brown.

Osawa No. 6. Samples of this coal taken from the outcrop, in the bed of the small stream "Osawa," in the same vicinity as the last named coal.

This is a handsome, hard, black, lustrous, and very solid coal; which will bear handling. Breaks into large irregular shaped pieces. Streak dark brown. Color of powder also dark brown. The specimens show numerous small patches of a white crystalline efflorescence over their surface.

The coal (?) of the lowest benches (No. 15) is a dark purplish brown carbonaceous shale, with a dull and earthy lustre. Streak brown; powder light brown.

The coal (of the upper benches) ignites very promptly. Decrepitates violently and falls into small pieces, choking the fire. Burns slowly with a long, bright and almost smokeless flame. After a short time the small pieces soften and cement together; forming a better and more open fire.

The coal of the lower benches lights with more difficulty, but burns quietly with a short bright flame. It cracks in burning but is held together by thin layers of a caking coal. The heat ceases with the flame.

Ash, of upper bench, light and powdery; of the lower benches a shale-like cinder, containing thin seams of a porous coke. Coke hard, solid and lustrous, but rather close grained. Lower bench does not coke. Both coals give a strong smell of sulphurous acid in burning.

Osawa No. 9. Samples taken from outcrop of this coal, a short distance up stream from Osawa No. 6. Coal hard, black and lustrous; that of the third and fourth benches quite fragile, but of the fifth and sixth more solid. No specimens were taken from the first or lowest bench, but the coal (?) will resemble that from the lower benches of Osawa No. 6. Coal breaks into prismatic pieces. Streak black; of the fourth bench, brown.

Powder, in each case, very dark brown. Specimens more or less stained with oxide of iron, but show little pyrite.

The coals of this bed light with some difficulty, but burn rapidly with a long, bright flame, giving but little smoke. The fifth bench decrepitates a little at first, but soon softens and cakes together. The coal of the other benches does not alter in the fire, but preserves its form, cracking a little, but not falling to pieces. That from the third and sixth benches gives a strong smell of sulphur in burning.

Ash light and powdery, containing some slaty cinder. Coke, from the fifth bench, hard, solid and lustrous, that of the sixth bench less solid and not so lustrous, neither coke very porous. The coal from the other benches does not coke.

Ogurasawa No. 3. Samples taken from the outcrop of the coal in the bottom of the small ravine of the brook "Ogurasawa," a branch of Osawa. Coal black, very hard and solid, but having a dull and stony lustre. Will bear very rough handling. The coal contains sometimes thin seams having a bright shining lustre. Cleavage cubical. Streak brown; powder very brown.

Lights easily and burns quite slowly with a long, bright, and rather smoky flame. Coal retains its shape in the fire, exfoliating a little but not breaking up. After the flame has ceased, the remaining coals glow with considerable heat and burn completely to a white powdery ash.

Ash, as above, retaining the form of the coal, but falling to powder on being touched. The larger pieces sometimes contain a little unburned cinder at the centre of the mass. Does not coke.

Furushiki Coal. Sample taken from the bed of the Tamagawa river, near the abandoned Furushiki mines. Coal bright, black and lustrous, soft but quite solid. Will

bear transportation. Contains thin seams of "slate." Cleavage irregular and laminated. Fracture hackly. Streak black; powder brown.

Ignites with some difficulty, and burns very slowly with a short, bright flame and considerable smoke. Swells, intumesces, and melts to a soft pasty mass, which chokes the draft and requires continual stirring to keep up the flame. After the flame has ceased there remains a large mass of very porous coke, making a good glowing fire.

Ash, pulverulent, containing some slaty cinder. Coke hard, very lustrous, exceedingly porous and quite solid. The coal in coking seems to swell about three hundred per cent! This coke gives a slight smell of sulphur in burning.

This is a most valuable coal for coking purposes. Alone, and improperly treated it will yield but an indifferent coke; both on account of the large percentage *of ash, and because the coal* swells to such an enormous extent, forming a *light* and almost worthless coke.

By crushing the coal to a fine powder, and washing in a properly constructed "jig;" the slate, which in this coal forms the bulk of the ash, and the pyrite, which is equally objectionable, can be readily and quite thoroughly removed. One part of this purified coal, mixed with four or five parts of a non-caking coal, and coked in a suitable coke-oven, will make a very valuable fuel for iron smelting or other metallurgical purposes. The non-caking coal added, should have as little ash and sulphur as possible; or if an impure coal be used, it should be previously crushed and washed as above.

By this latter plan some of the poorer Kayanoma coals, otherwise of little value, may be utilized and at a very small expense converted into a valuable fuel.

Onkosawa Coal, from the Chatsunai Valley, near Kayanoma. Specimens taken from the outcrop of the coal, "one foot, plus or minus, above bottom of five foot bench." Coal black, lustrous, hard and solid; "perhaps a little bony at top and bottom of bench." (B.S.L.) Streak black; powder very dark brown, almost black.

Coal ignites quite quickly and burns rapidly with a long bright flame, giving little or no smoke. Cracks and falls to pieces in the fire. Leaves a large amount of unburnt cinder. Does not coke.

HORUMUI COAL.

From the Province of Ishikari, Yesso.

No. 1. Marked (L. 576 i.) "Six Specimens from "middle of bed * * * apparently a fair average of bed." A fine, black, lustrous and solid coal. Streak black; powder very dark brown, almost black.

No. 2. Marked (L. 602 a.) "Six (apparently average) "specimens from one and a half feet, plus or minus, below "top of (5 foot) bed." This is also a fine, black, lustrous coal; quite hard, but not so solid as No. 1. Streak black; powder almost black.

No. 3, *upper bench.* Marked (L. 602 ba, 1.9.) "Four "samples from the one and nine-tenths foot bench." A fine, black, lustrous coal, hard and very solid. Streak and powder like No. 1 and No. 2.

No. 3, *lower bench.* Marked (L. 202 ba, 5.) "Six "average samples from one and one-half, plus or minus, "feet below the top of the five foot bench." Coal black, very lustrous, hard and solid. Streak, &c., as above.

No, 4, *upper bench.* Marked (L. 602 ca, 4, 2.) "Six "(average) specimens from one-half foot above bottom of "four and two-tenths feet bench." Coal black, of medium lustre, soft and somewhat friable.

No. 4, *lower bench.* Marcked (L 602 ca, 2. 7.) "Five "(average) samples from one and one half feet below top "of two and seven-tenths foot bench." Coal black, of medium lustre, and neither very hard nor very solid. Fracture hackly. Streak etc. like the others.

No. 5. Marked (L 603 e.) "Six (average) speci- "mens from one foot, plus or minus, above the bottom, "taken from exposure in high-water bed of brook." This is a fine, black, lustrous, hard and solid coal; having an irregular prismatic cleavage. Streak, etc., as the other coals.

No. 6. Marked (L. 603 g.) "Six (average ?) samples "from about the middle of the bed, thirty-five feet above "station." Coal black and of medium lustre, soft and friable.

These coals behave very much alike in the fire. All ignite with some difficulty, and burn rather slowly, with a bright flame of little more than medium length, giving but *little* smoke. *All* crack and open somewhat in burning, but only Nos. 2 and 6 fall to pieces. They do not melt or cement together in the fire. Number one seems to swell a little.

Coke: Numbers one and two give a soft, friable, rather dull and close-grained coke. Numbers 3, 4 and 5 give a hard and solid coke of medium lustre, but not very porous. That from the lower bench of No. 3 is more friable than the others. Number six does not coke.

Ash, very small quantity, powdery and rather heavy.

SORACHI COAL.

From the province of Ishikari.

The two specimens of Sorachi coal are externally very much alike. Fine, handsome, black, lustrous, hard and solid coals; with an irregular and uneven fracture. The coal breaks easily, however, and will probably make considerable slack in mining. Streak black; powder very nearly black.

Ignites quites easily and burns rather slowly with a bright flame of about the same length as that of the Mitsumui coal, but somewhat more smoky.

Coal cakes in the fire, softening and cementing to a pretty solid mass, which burns freely without stirring, and leaves a large mass of porous coke, containing little or no sulphur.

Ash, very small quantity, rather heavy.

Coke, very hard, solid and lustrous, but somewhat close in texture. Volume the same as that of the coal.

COAL.

From other parts of Japan.

Hiyamidzu Coat. From the province of Iwaki, Iwamai Ken, on the northeast coast of Nippon. Specimen taken from General CAPRON'S cellar. Coal hard, black and solid; lustre rather dull. Cleavage *cubical*. *Will* probably weather badly, and *fall to pieces if exposed*. Streak, dark brown; powder brown.

Inflames readily and burns rapidly with a clear, bright flame of medium length, giving but little smoke. Preserves its shape in the fire.

Ash, light and powdery, containing but little cinder. Does not coke.

Kadzuno Lignite. Specimen brought by Mr. JANIN from the Kadzuno mines in the province of Ougo, Akita Ken, on the northwest coast of Nippon. Black, dull and soft; with a cubical cleavage. Has a fibrous structure, showing the grain of the original wood, cuts, splits, and breaks like a mass of solid compressed charcoal; and in fact resembles charcoal more than coal. Streak, very black; powder, very dark, almost black.

Lights easily, and burns rather slowly with a short feebly luminous flame. It cracks and opens in burning,

but holds together, only falling to pieces when disturbed. After the flame has ceased there remains a large mass of glowing coals, which yield a slight smell of sulphur in burning.

Miike Gas Coal. From the province of Bizen, Okayama Ken, in the south of Nippon, on the Inland Sea. Specimens from the Bussankioku collection. Said to be the coal used at the Yokohama gas-works.

Black and rather dull, soft and fine grained. Streak, black; powder, very dark brown. Ignites with some difficulty, and burns in all respects like the Furushiki coal.*

Coal swells about fifty per cent in coking. Coke hard, lustrous, solid and porous.

Funakimura Coal. From the province of Chosiu, Yamaguchi Ken, at the southwest extremity of the island of Nippon. Specimen from the Bussankioku collection. Color, very black, with a bright resinous lustre. Very hard and solid. Cleavage, cubical. Streak, black; and powder, also black. The specimen received is full of small bright scales of pyrite.

Coal kindles with some difficulty, but burns very rapidly with a long bright flame. Cracks and falls to pieces in part, swells a little and becomes porous, but does not soften or cake. Gives a distinct smell of sulphur in burning.

Does not coke.

Karatsu Coal. From the province of Hizen, Saga Ken, on the northwest coast of the island of Kiusiu. Specimens from the Bussankioko collection. Coal black, lustrous, hard and solid. Cleavage more or less cubical. Streak, dark brown.

* See page 24 of this report.

Inflames with some difficulty; burns very rapidly with a long, bright flame, giving little smoke. Coal preserves its form in the fire, and becomes somewhat porous, but does not coke or cement together.

Coke very hard, solid and lustrous, but somewhat close grained.

Takashima Coal. From the province of Hizen, Saga Ken, a little to the south of Karatsu. Specimens furnished from the Bussankioku collection. Coal black, very lustrous, hard and quite solid. Breaks into long irregular prismatic-shaped pieces. Fracture hackly. Streak black; and powder in thin films, very dark brown.

Kindles slowly, and burns in all respects like the Miike and Furushiki coals.*

Coke very hard, solid, lustrous and very porous. Coal swells about fifty per cent in coking.

These tests of the burning properties of the different coals were made upon small quantities and under circumstances very favorable to complete combustion; it may happen therefore, that some variations from these results will be found in practice, especially as regards the amount of smoke, the breaking up of the coal in the fire, the quantity of unburned cinder in the ash, etc., etc.

A difference will be noticed between the color of the streak, given by the coal, when drawn across a surface of white porcelain, and the color of the powder, as seen in thin films by reflected light. This is caused by the varying hardness of the coal; a soft coal leaving a thick black line, and a harder coal a narrower and brownish one. The color of the powder, therefore, affords a better indication of the quality of the coal than the streak. A *brown streak* is, by some authorities, given as a charac-

* See page 24 of this report.

teristic of lignites or brown-coals. The powder of bituminous coals is, however, always more or less brown, whether they are of modern origin or true carboniferous coals.

The coals examined may be divided into four classes, as follows; the coals of each class being arranged according to the ratio of fixed carbon to one of volatile matter, the best coals first.

1st.—*Fat, caking blacksmith's coals;* Furushiki, Takashima, and Miike coals.

2nd.—*Caking Coals.* Sorachi No. 1, Sorachi No. 2, Honshiki, Horumui No. 5, Horumui No. 3, Midzunuki, Karatsu, Horumui No. 4, Osawa No. 6.

3rd.—*Free burning, or steam coals;* Funakimura, Tateire, Horumui No. 1, Horumui No. 2, Osawa No. 9, Horumui No. 6, Chatsunai, Hiyamidzu, Ogurasawa, Kosawa No. 4.

4th.—*Lignite;* Kadzuno lignite.

ULTIMATE ANALYSES.

With a view to determine more exactly the value of these coals as compared with similar fuels from other parts of the world, a few of them have been submitted to ultimate analyses, with the results given in the following table.

Method of Analysis. The combustion of a weighed sample of dried coal was effected with chromate of lead, in a current of purified air, and in an iron combustion tube, after Cloëz's process.[1] The products of combustion were passed through a series of U tubes ; one filled with pumice, moistened with sulphuric acid, to absorb the water ; and another filled with soda-lime, which absorbed the carbonic acid. Attached to the soda-lime tube was a small sulphuric acid tube, to arrest any moisture taken from the soda-lime by the dry air. The *hydrogen* was calculated from the increase of weight of the first tube, and the *carbon* from the increment of the two latter.

The *sulphur* was determined by fusion with potassium hydrate and potassium nitrate in a silver dish ; with precipitation by barium chloride as usual, &c., &c., after Von Liebig's[2] process. The silica was separated from the solution by evaporation to dryness, &c., before precipitating the sulphur, and the barium sulphate due to the reagents was deducted in each case from the final result.

The *moisture* was determined as before[3] and the *oxygen* and *nitrogen* found "by difference."

1.—Fresenius. Quantative Analysis, London 1865. § 192, p. 506.
2.—Fresenius. § 188. a. 1. p. 498.
3. See page 15 of this Report,

The *combined water* was calculated by adding to the oxygen (assuming the nitrogen at 1.2 per cent*) one eighth of its weight of hydrogen. The remainder of the hydrogen is supposed to be available as fuel, and is given in the table under the heading "*free hydrogen.*"

From these results are calculated the calorific powers given in the table. These are expressed in centigrade heat units and represent the weight of water raised one degree centigrade by one part of fuel.

Calorific Power I is found by multiplying the percentages of carbon and free hydrogen by their respective calorific powers, 8080 and 34,462.

This result might be approximated in a calorimeter; or wherever the burning of the fuel is complete, and the residues and products of combustion are cooled and made to give up their absorbed and latent heat.

Calorific Power II, is found by deducting from I the units of heat necessary to vaporize the moisture, combined water and water of combustion of the fuel. (536.5 units for each unit of water.)

This calculation is made on the supposition, that the products of combustion are cooled only to 100° C., as when the fuel is used for the evaporation of water; and that only the exact amount of air, (at 100° C.) necessary to the perfect combustion of the fuel, is supplied to the fire. The initial temperature of the fuel, as well as of the air, is supposed to be 100° C. The figures given in this line will therefore express the greatest effect obtainable from the fuel, when used in generating steam.

Weight of water (*at 100° C.*) *evaporated by one part of coal, I.* Obtained from Calorific Power II. by dividing by 536.5, the units of heat absorbed by one part of water at 100° C. in passing into steam of the same temperature.

* The mean amount of Nitrogen in eight American Lignites having nearly the same compositions as these coals.

This gives the maximum amount of steam that will be produced by one of fuel ; or in other words, the pounds of steam evaporated by the burning of one pound of coal.

Weight of water (at 100° C.) evaporated by one part of coal, II. According to Johnson's[1] experiments the evaporative power of a fuel is independent of the percentage of free hydrogen it may contain.

By taking 7,170 for the calorific power of carbon, as given by Dulong ; and 572°2 C. (1,030° F.) for the latent heat of steam,, as determined by his own researches, he obtained theoretical results from the carbon alone, agreeing almost precisely with the figures given by direct practical experiment. But Dulong's co-efficient for carbon is too low, and Johnson's determination of the latent heat of steam is too high, both errors tending to make the calculated results too low ; and on recalculating his work with the more recent coefficients, the agreement is by no means remarkable.

The figures in this line are nevertheless calculated with the coefficients used by Johnson, and will probably give figures approximating very closely to actual practice.[2]

The *temperature of combustion* was found by dividing Calorific Power II. by the heat-units necessary to raise the products of combustion one degree centigrade. The products of combustion were calculated on the supposition, that the carbon burns completely to carbonic acid, the hydrogen to water, and the sulphur to sulphurous oxide. These products ; with the hygroscopic and combined water, the nitrogen, and the ash of the fuel, and also the nitrogen of air necessary for combustion ; were multiplied by their respective specific heats, and the sum taken for the divisor mentioned above.

1. Coal Trade of North America, W. R. Johnson, Phila, 1850, page 111 et seq.

2. Johnson's experiments show results ranging from 7.34 to 10.40 lbs of water evaporated by one pound coal.

This calculation assumes the initial temperature of the air and fuel to be zero degrees, also that only the exact amount of air necessary for combustion is admitted to the fire; and finally, that the combustion of the fuel is perfect and complete.

It will perhaps be interesting to compare these coals with fuels from other parts of the world. For this purpose I have taken the following table from Percy's Metallurgy,[1] making a few interpolations. For convenience in comparison the analyses are calculated for 100 of carbon, and arranged according to the amount of oxygen; beginning with wood, and ending with the most perfect coal—Anthracite.

	Carbon.	Hydrogen.	Oxygen.
1. Wood, (mean of 26 analyses)	100.00	12.18	83.07
2. Peat	100.00	9.85	55.76
(a) Lignite[2] (average 22 varieties)	100.00	8.52	44.73
3. Lignite (average 15 varieties)	100.00	8.37	42.42
(b) Lignite or Brown Coal[3] (average 9)	100.00	8.33	32.03
(c) American Lignites[4] (average 8 varieties).....	100.00	6.46	23.72
4. Ten Yard Coal, S. Staffordshire, England	100.00	6.12	21.23
5. Steam Coal, Tyne, England.	100.00	5.21	18.32
(d) "Block" Coal, Ind. U.S.	100.00	6.17	16.13
(e) Japanese Coal (average)	100.00	7.37	15.95

1. Die Metallurgie, von John Percy, M.D., F.R.S. Braunschweig, 1853, I. Bd. s. 98.

2. From Austria. Saxony, Prussia, Russia, &c.

3. From France, Germany, Austria, Greece, &c.

4. See note, Table III. From California, Oregon, Alaska, Utah and Wyoming, U.S.

(*f*) Sorachi Coal (Yesso)...	100.00	7.37	14.30
(*g*) Caking Coals, England. (average 8).....	100.00	6.72	10.91
(*h*) Furushiki Coal (Yesso)	100.00	7.61	10.24
6. Anthracite, S. Wales, Engl.	100.00	4.75	5.28
7. Anthracite, Penna., U. S....	100.00	2.84	1.74

It will be seen on inspecting this table, that these Japanese coals are widely removed by their composition from all coals of similar age, and can be compared with the best carboniferous coals. They are therefore neither *lignites* nor *brown coals*, but true *bituminous coals*.

In concluding this report I must render thanks to the officers of the Kaitakushi, for their evident interest in this work, and for the liberality with which all necessary apparatus, chemicals, etc., were provided for my use. I must also acknowledge the services of Mr. Nakano, interpreter and student-assistant, who has cheerfully and in many ways afforded me much valuable assistance.

Respectfully submitted,

HENRY S. MUNROE, E.M.

Assistant Geologist and
Mining Engineer.

TRIGONOMETRICAL SURVEY OF YESSO.

REPORT

OF THE

HYDROGRAPHIC RECONNAISSANCE

OF THE

ISHIKARI RIVER,

ISLAND OF YESSO,

BY

MURRAY S. DAY,
LIEUT. U. S. N. & ASST. SURVEYOR, KAITAKUSHI.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1874.

TOKIO, JAPAN, *April 21st*, 1874.

To

General HORACE CAPRON,

Commissioner and Adviser to the Kaitakushi.

SIR,—I have the honour to submit the following report, with the accompanying charts, of the Hydrographic Reconnaissance of the Ishcari River from its mouth to that of the Horumui.

In accordance with the plans which were submitted to you by Mr. Wasson, I was to make a hydrographic survey of the river from its mouth to that of the Barato, and after completing this, was to join his party and assist him in his work of locating the upper section of the river and some of its largest tributaries. But in consequence of the bad weather and the scant assistance furnished me, the work progressed very slowly at first, so that a month had elapsed by the time I reached the Barato; during which time Mr. Wasson had gone so far up the river, that I decided not to attempt to join him, as it would take me at least three weeks to do so, and I would then have found him preparing to come down, it being so late in the season. Besides, the soundings up to this point had shown

the existence of such a fine channel, that I was very anxious to continue the work further, and if possible, to reach the Horumui, in the vicinity of the newly discovered coal regions.

Unfortunately, just before starting from Sapporo, Mr Arai met with an accident, which prevented his moving for several days, so I started with the rest of the party consisting of Mr. Matsmoto, Mr. Nakamura and Mr. Hiyashi (who was temporarily assigned to me as interpreter) and on the third of September reached the town of Ishcari at the mouth of the river.

The system of survey I proposed carrying out was that ordinarily used for river work, which consists in triangulating from an established base line to flags staked out at convenient distances from each other on either bank of the river; and at each flag, measuring the angle between the other flags visible. The stakes at which the flags were placed in our work were numbered and marked—L. 1, L. 2, L. 3, &c., on the left side of the river, and R. 1, R. 2, R. 3, &c., on the right side, the No. 1 stakes being opposite each other at the mouth. The triangulation being carried up the river in that way for about a mile, the soundings were made between the flags on opposite banks, and when completed, the flags where shifted to other stakes further up, and so on.

We selected as a place for the base line the low sandy point at the mouth of the river on the left shore, and located it in such a position as would enable its northern end—the Initial Point—(marked "A" on the chart) to be seen from any point on the bar. After three careful measurements we found the line to be 22151 metres long, and its magnetic bearing from the initial point to be *south* 51° 21′ *east*, At each end of the line we buried a post five feet in the ground; and over the initial point had erected a tripod of beams twenty-two feet long and one

foot in diameter, with the heels buried five feet in the ground, and so placed that a plumb-line suspended from the head of the tripod hangs directly over the point. This signal is very substantially put up, and should stand for several years. It can be used hereafter as a station on which to triangulate when a more accurate examination of the bar may be required. And it also marks the point which it will be desirable to connect with the trigonometrical survey next season.

In order to do the work on the bar I found it necessary to erect two more permanent signals : one on the right bank of the river (marked "H" on the chart) whose distance is 867 metres from the initial point, and whose magnetic bearing from it is north 45° 38′ east : and the second one (marked "M" on the chart), on the north-east shore of the bay, distant 1,344 metres from the initial point, and bearing north 41° 22′ east from it. These three permanent stations together with a "Look-out" (marked "L" on the chart) will be all that will be necessary for further work in sounding in this vicinity.

The examination of the bar was not so extended as I would like to have made it, but I was obliged to content myself with the few soundings we made, as the strong north-west winds had set in, which for the time being prevented soundings on the bar, especially as the boat and crew were entirely unfit for the work. It was impossible to find a man who understood handling the lead and line, so I was compelled to do this work myself, or else abandon the survey. We were, however, successful in obtaining sufficient data to enable us to establish the position of the channel on the bar, and to ascertain to a certainty that in it there was *not less than* 12 feet of water.

This channel (containing 12 feet of water) is about 1200 feet long and from 600 to 800 feet wide, and judging

from the soundings taken the character of the bottom seems to be uniform throughout and of hard sand. After passing over the bar, in coming out of the river, the channel deepens to three fathoms and more ; and we found that about one mile off shore there is very good holding ground for vessels in anchoring, where there are six and eight fathoms of water, and a clay bottom.

It may safely be said that the position of the channel on the bar does not remain constant for more than one season. The mouth of the river being exposed to the north-west and westerly gales, which prevail during the winter months, the sand is washed in and deposited on the bar, filling up the channel, and as there is not sufficient current in the river during this season to oppose the action of the strong winds on the sea-water at the mouth, this deposit remains until the spring, when the ice breaks up and the freshets occur, which scour out a new channel. At the same time comes the general change in the winds. The south and easterly winds set in and last till the early part of September, during which time the water is perfectly smooth on the bar, and the navigation in and out of the river very safe.

Should it be decided to use the river for transporting coal from the Horumui region, a survey of the bar at the mouth should be made every spring, and the channel buoyed out. This would be a work of about one week's time ; using the stations established by us, for locating the soundings.

A Tide-Gauge was established in the basin of the piers on the right side of the river opposite the town, and was given in charge of Mr. Nakamura, the draughtsman of the party. The observations were made every twenty minutes for twenty-three consecutive days, the results of which show a mean rise and fall of *seven-tenths* (0.7.) of a foot. At times, however, during westerly gales the gauge would

show a rise of two feet and more, the rush of water into the river being considerable.

From the current observations taken on different days we found the mean velocity to be two and one-half miles per hour. The fact that such a current exists with so small a tide opposing it is sufficient reason for supposing that the channel on the bar is kept clear during the summer season.

On the 15th of the month Mr. Arai joined us, after which we were enabled to divide the party, he taking the triangulation, and I the sounding, and in this way our work progressed more rapidly.

We remained at the mouth of the river till the 29th, when, having completed the triangulation and soundings to within two and a half miles (one *ri*) of Sapporobuto, we moved to this point.

During the twenty-five days stay at Ishikari we had but *twelve working* days owing to the bad weather. But this was considered by fishermen and others, who have lived in the locality for several years, an unusually early season for the westerly winds, and a very severe one. On the afternoon of the 27th a remarkable phenomenon occurred. A very heavy cloud, hanging over the bay to the westward, broke and formed *four distinct water spouts*, such as are seen in the tropics. They travelled to the eastward at the rate of at least 15 miles an hour, and did not disappear till they struck the shore some twelve miles to the northward of the town. The tops of the houses were crowded with the inhabitants who appeared to be very much excited by the occurrence ; and I learned afterwards that they had not seen anything of the kind in that locality for twelve years.

While at Ishikari, Mr. Matsmoto made a very good survey of the town with compass and chain, a map of which may be useful to refer to hereafter. He also ran

a line of levels up the river as far as Sapporobuto, and found the fall to be 12.6 feet.

By the 16th of October we had completed the work to a point about five miles (2 *ri*) above Sapporobuto. On the following day we moved up the river and went into camp two miles and a half above this point. The work continued without interruption, except by bad weather, until the 22nd of the month, when, having extended it so far above the camp, we moved again to the mouth of the Toyohira; and on the 29th made our final camp opposite the mouth of the Horumui. On the same day Mr. Matsmoto was sent in charge of a party to locate the Horumui river as far as possible. He worked till the 9th of November, when the severe weather stopped him, he having reached a point 12¼ miles (or 5 *ri*) up the river from its mouth.

The triangulation and soundings were completed on the 31st of October, to the mouth of the Horumui, though not before a severe snow storm had set in. The following day we moved to Sapporo, and on the 7th of November went to Tokarumui, having received information that Governor Kuroda wished us to determine the distance between that place and the town of Mori, on the opposite side of Volcano Bay. This work completed, we went to Hakodate, and there awaited the arrival of Mr. Wasson's party.

It will be seen, by referring to the charts, that there is a good channel, with an average width of 360 feet (or 1 *cho*) and a depth of three fathoms and more, extending for a distance of 16 miles (or about 6½ *ri*) from the mouth of the river; and five and one half miles (or 2¼ *ri*) above the mouth of the Barato river. At this point it gradually shoals to 16 feet, and between it and the mouth of the Horumui, the channel varies, but in no place is it less than fourteen feet. These shoals in the river probably

change their positions somewhat every year, but for such navigation as would be required in the transportation of coal it would be a matter of no serious consequence. Should the Department decide to make use of the river for this purpose, I would suggest that lighters or scows, with a carrying capacity of from 50 to 100 tons could be built at the town of Ishikari, which could, during the summer season, take their cargoes to the anchorage off the mouth of the river with perfect safety.

Though it will perhaps be necessary to examine the channel for the purpose of clearing it of snags and drift trees, as during the freshets each season there are a great number of trees washed away from the banks, which either sink in the deep water or are deposited on the shoals.

The accompanying charts show the distance surveyed to be 35½ miles (or 14½ *ri*).

The number of angles measured were 3,085, and the number of soundings taken were 7,777.

In conclusion, I desire to express my thanks to Mr. Arai, whose knowledge of surveying, both theoretical and practical, cannot be doubted, and to whom I am under many obligations for much kindness and consideration shown to me during the time we have been associated together.

The work performed by Mr. Matsmoto reflects credit on him and stands as a proof of his ability.

I am also indebted to Mr. Hiyashi for his services generally, and especially as the recorder of soundings.

Very respectfully.

Your obedient servant,

(Signed) MURRAY S. DAY,
Lieut. U.S.N., Asst. Surveyor
Kaitakushi of Hokkaido.

TRIGONOMETRICAL SURVEY OF YESSO.

ABSTRACT

OF A

PRELIMINARY REPORT

OF THE

SURVEY OF HOKKAIDO,

SHOWING THE PROGRESS OF THE SURVEY AND OTHER WORK DURING THE YEAR 1873,

UNDER THE DIRECTION OF

JAMES R. WASSON,

Surveyor-in-Chief, Kaitakushi, Hokkaido.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

Tokio, Japan, March 30th, 1874.

To

General Horace Capron,

Commissioner and Adviser,
Kaitakushi of Hokkaido.

Prefacing his report, Mr. Wasson says that it cannot fairly be called a report of the survey which had been entrusted to him, since the actual operations of the work have, from various reasons, been retarded to an extent that could not have been foreseen at the time the party took the field. It serves, however, to show the manner in which the party under his control has been employed and the progress in the work up to this time.

Immediately upon his appointment to the work of the Trigonometrical survey of Hokkaido, early in March, Mr. Wasson made application for a number of young men as assistants. Personal experience had given him knowledge of the competency of certain of the assistants formerly connected with the engineering party of Major Warfield, and he made application for the services of six of these, requesting also that the number of assistants should be increased to ten as that was the smallest number he could use to advantage in the work contemplated. The

party as finally organized in Tokio, were, besides Mr. Wasson, as follows :—Arai Ikunoski, Assistant; and Student Assistants Mizoguchi, Seikei, Nozawa, Nagai, Nasa, Matsumoto, Takemura and Teradzawa ; Interpreter Yezoi ; Paymaster Hiraibiashi.

Mr. Wasson's application for a foreign assistant and his requisition for instruments, made March 14th, 1874, having been approved they were ordered at once from the United States.

On the 19th of April the party sailed for Hokkaido in the Japanese steamer *Hokkai Maru*, arriving in Sapporo on the 29th of April. The weather was fine, although some snow still remained on the hills around Sapporo. Mr. Wasson was disappointed in not being joined by Mr. J. R. Clark, who had been interpreter and assistant to Major Warfield the former year. The Japanese interpreter was but of little service, especially where it was necessary to be constantly using terms relative to the work of surveying of which he had no knowledge whatever.

After waiting in vain until May 5th for his luggage and provisions which had not arrived from Otaru, on that date Mr. Wasson and party took the field. Watsu, twelve miles from Sapporo, was selected as a camp from which to take up the location of the new road where it had stopped the year before. Work was begun on the 6th and the location was pushed very rapidly, notwithstanding the difficult nature of the country, and was completed on the 17th, the work having been brought to the Toyohira river. Many of the hills and disagreeable features of the line from Shimamapu were avoided entirely or overcome by easy grades, the road being also shorter than the corresponding section of the old one. The location being completed, Mr. Wasson was occupied for several days in preparing the necessary estimates for the "cutting," "fillings" &c. Those in charge of working parties

had allowed the laborers to do their work in a very slovenly manner in the latter part of the preceding year, and in consequence the road was quite defective in many places. Mr. Wasson gave written instructions as to the manner in which the work was to be done, which were so well observed that the road from Shimamapu is much better constructed than the other portions, and will last much longer without repairs. The bridges, however, in many cases, have been clumsily constructed. The abutments and piers are so large as to partially dam the streams, and so insecure as to render their destruction, in the event of freshets inevitable. The piles, too, are driven but a short way into the ground and cannot stand long. It would not be an expensive matter to put suitable bridges over the streams along this road as most of them are short spans where a light panel bridge would answer the purpose, while in the case of larger streams a panel bridge of more than one span, or better still, a truss-bridge would be sufficient. By erecting such bridges the road can be kept open the whole season, while without them it must be closed at times to traffic.

Having completed the location of this road Mr. Wasson prepared to enter upon the work of triangulation. Enquiry among the Japanese, in which he was materially assisted by Governor Matsumoto and Mr. Arai, had apprised him of the existence some 150 or 200 miles up the Ishcari river of a large, open valley, which he thought would prove a favourable site for the establishment of a "base line." It was resolved to ascend the river to this place with a small party. On the 25th of May this party, consisting of Messrs. Wasson, Arai, Yezoi, Hiraibiashi, and an interpreter who understood the mixed Japanese and Aino dialect, took boats at Shinoro. The 6th June they arrived at Ichan, 45 *ri* up the river; from thence the current was so strong and the rapids so

numerous that the party embarked in Aino boats which were better adapted to the journey; at places the navigation, even with these canoes, was most dangerous. June 8th the party encamped at the mouth of the small tributary, the Hirushinai and on the following day reached Kawakami at the lower end of the valley. This valley after careful examination was found to be unsuited to the location of a proper "base line," it being difficult to locate a line of the required length, with good stations for triangulation at its extremities. The party accordingly returned to Sapporo, which place they reached on the 7th of June.

Although defeated in the main object of his journey, Mr. Wasson does not regard the expedition as destitute of good result as it had an important influence on the work of the ensuing months. He was forcibly impressed with many of the features of the valley. It is surrounded by mountains, which protect it from winds and have a beneficial influence on the climate; it is well watered and timbered and most of its soil is fine.

During Mr. Wasson's absence that portion of his party left at Sapporo had spent the time in familiarising themselves with the use of the instruments, making surveys of the town, &c.. Upon his return the whole party started for Yubutsu on the east coast, in the vicinity of which it was intended to locate a "base line." The ground at this place for several miles is low and marshy, and is intersected by numerous streams. The shape of the coast rendered it difficult to get a line of the length desired, which would at the same time be entirely on the good ground. The problem to solve was to get a line of a certain length from both ends of which the most prominent landmarks could be seen and which would avoid the swamp land and cross the smallest possible number of streams. The solution required great labour and the

utmost precision, as upon its accuracy depended the success of the future work. It was finally decided to place one end of the line at Yubutsu as far back from the coast as possible and from thence to run up the coast in such a direction as to just avoid the sea (the coast being here a gradual curve) to a point four miles distant, in this way obtaining a line about nine miles in length, which fairly fulfills the required conditions. This line was measured roughly with a common chain, but the rods made at Tokio were found to be so inaccurate that they were useless, and Mr. Wasson was therefore unable to make a first approximate measurement, until the instruments should arrive from the United States.

Sometime previous he had made arrangements for the erection of stations at the ends of the base, and for placing the stone pillars which were intended to carry each a copper bolt in which would be marked the points in which the base terminated. He found great difficulty in making these arrangements on account of the cost. The first estimate, $1,500, he considered entirely too high, as the stations were to be but 40 feet in height and built of timbers which could be secured and roughly hewed with but little difficulty and at but a small distance from where they were to be used. He finally succeeded in getting the stations built for about one-third of the above estimate.

Concluding this portion of his report, Mr. Wasson says that he considers the "base line" above mentioned the most favorable "primary base" that could be made. At a future stage of the work it will probably be necessary, he thinks, to establish one or more "bases of verification." The plain at Hakodate and a long, level line of beach between Oshamambe and Yurap he considers suitable places for such bases. The approximate magnetic bearing of the Yubutsu base is S. 62° E.

In the beginning of July Mr. Wasson returned to Sapporo. At the request of Governor Matsumoto, he ran a line of levels from the headgates of the canal through Sapporo to the Ishcari at the mouth of the Barato for the purpose of ascertaining the practicability of constructing a good navigable canal from Sapporo to the Ishcari. He found the fall to be eighty feet from the north end of Sapporo, where it was proposed the canal should commence ; the fall he considers too great for the construction of a good canal, the distance being eight miles. As the soil is light and porous and a great many locks would be required, the expense must necessarily be excessive. The object to be attained by such a canal would, he thinks, be better secured by the construction of a good tramway, to which the nature of the route is admirably adapted. The grading could be done at no great cost and in the most durable manner, gravel for ballasting being near at hand. Such a tramway with a good, light T rail, and a three feet gauge, could be built in a manner that would combine many advantages, and might be used either for horse or steam power.

It being desired to ascertain whether the ground along the canal passing through Sapporo would allow an increased head of water at the mill grounds, Mr. Wasson ran several lines of levels for the purpose of resolving this question. His investigations led him to the conclusion, that, owing to the general contour of the ground, it would be impossible to increase the head of water by carrying the water at or near the surface, and that an embankment would be necessary or that the water would have to be carried underground in mains, which latter he considers the better plan.

On the 18th of July Lieut. M. S. Day, U.S.N., the gentleman who had been engaged in the United States to assist in the survey, arrived at Sapporo. As the instru-

ments did not arrive, it was resolved to occupy the intervening time in a reconnaissance of the west coast to the head of Volcano Bay, arriving at Hakodate in time to meet the instruments and attend to their shipment to Yubutsu.

The party, consisting of Messrs, Wasson, Day, Arai and Nagai left Sapporo on the 29th of July, and proceeding via Otaru, Iwanai, and thence to Oshamambe and around the head of Volcano Bay, arrived at Hakodate on the 3rd of August.

On August 4th the mail steamer arrived at Hakodate, but it was found that only the instruments from Philadelphia, which were small and designed for the use of sub-parties, had arrived, and that the apparatus for measuring the "base line," for triangulation and for astronomical work had not come. After careful consideration of the difficulty and after the discussion of various plans of operation to occupy the time until the arrival of the instruments, which could not be less than a month, it was resolved to make a survey of the Ishcari river, its tributaries and valley, but little being known of this country which must soon attract the attention and labors of the Department. Such a preliminary survey would furnish a valuable map, and the work could be done in such a way as to form a part of the general scheme of survey. The entire force was to be divided into four working parties. One of these was placed under Mr. Day, It was composed of Messrs. Day, Arai and Matsumoto, and Mr. Hiyashi as interpreter. This party was to begin work at the mouth of the Ishcari, and make a survey and hydrographic reconnaissance of that river as far as the mouth of the Barato. Great importance was attached to its work, as no careful examination of the bar at the mouth of the river had ever been made and little was known of its channel.

The second party, consisting of Messrs. Seikei and Nasa, was to survey, with the transit, the Barato, the Shinoro and the Toyohira rivers and their larger tributaries. The work of this party embraced a large extent of country, a map of which, from its vicinity to the capital, would be especially valuable.

The third party consisted of Messrs. Mizoguchi and Nozawa, and was directed to make a survey, with the Chitose river and as many of its tributaries as possible.

The fourth party was under Mr. Wasson's charge, consisting of himself and Messrs. Nagai, Takemura, Yezoi and Hiraibiashi. This party was to carry the work up the Ishcari, commencing where Mr. Day's work terminated.

Owing to the nature of the work contemplated these parties were obliged to use other means than chaining for the measurement of distances. It was thought best, therefore, to employ the method used in the United States coast survey in doing detailed work with the plane table, the telescope of the alidade being supplied with stadial lines by means of which the distance from the point over which the instrument is set up, to a rod, graduated and marked for the purpose, is read directly. Preparing the instruments for this method, delayed the party until the 2nd September, when Mr. Day's party took the field as did the two parties in charge of Japanese assistants, the latter having received especial instructions from Mr. Wasson in the use of the "telemeter rod," &c.

The fact that Aino boatmen (who are more skilful than Japanese in navigating the swift current and the numerous rapids of the Ishcari) could not be obtained, delayed Mr. Wasson and his party considerably in their work. The party was divided into three sections; Mr. Wasson himself took the instrument and made all the measure-

ments, to insure greater accuracy; while he adjusted the instrument an advance section would select a new station for the next position of the instrument, and a section in the rear would give him the "back sights." In this manner the work progressed at the rate of from three to eight miles a day, until, on the 18th of October, the party reached the mouth of the Aibetsu, a small tributary of the Ishcari. Meanwhile the difficulties in the navigation of the river had greatly increased, while the weather had grown very much colder. The Japanese boatmen were suffering severely from their frequent immersions in the cold water, and were very desirous of turning back. Under these circumstances, and desiring also to survey the Chubetsu river, a tributary of the Ishcari at whose mouth the party had stopped on the 12th of October, Mr. Wasson resolved to return to the Chubetsu. While returning, the party met with an accident that threatened serious consequences. At a sharp bend of the river two of the boats were upset, and although their occupants were not drowned, much of the most important camp equipage, tents &c., were lost. Some of these were recovered with much difficulty. On the 21st the party commenced work on the Chubetsu, and, although delayed by rainy weather, finished on the 26th at the mouth of the Biyé.

On the 31st of October, Mr. Wasson and party reached the Sorachi, and made preparations for their work, but bad weather set in and it became evident that there would be no more working weather. They accordingly returned to Sapporo, reaching that place on the 6th of November. Here it was found that Mr. Day had finished his work on the Ishcari as far as the mouth of the Horumui, and that the other parties had also returned, having completed their work.

On the 24th of November Mr. Wasson, in company

with Mr. Day and Mr. Arai, returned to Tokio. Upon their arrival preparations were made for working out their notes of the summer, making charts, maps &c. The accompanying map of the Ishcari is not intended to represent the actual topography of the country. To make a complete survey of an area of the size of that embraced in this map would be the labor of many months for a larger and better equipped party than the one engaged in the work. As a general representation of the country, however, it is sufficiently minute and accurate for all practical purposes.

The following is a brief summary of the season's work, except that of Mr. Day, to whose report Mr. Wasson refers :—

Name of rivers surveyed.	*No. of Stations occupied.*	*No. of miles surveyed.*	*By whom surveyed.*
Ishcari	... 1,150.....	150.82...	J. R. Wasson
Chubetsu... ...	... 78.....	10.04...	„
Barato	... 456.....	17.65...	Mr. Seikei
Shinoro	... 546.....	17.65...	„
Toyohira... ...	... 580.....	36.14...	„
Chitose	... 233.....	10.36...	Mr. Mizoguchi
Yubari	... 459.....	40.76...	„
Fushi-ko-Yubari	... 41.....	3.13...	„
Moname	... 18.....	1.66...	„
Yuni	... 50.....	3.00...	„
Herbetsu... ...	... 25.....	1.61...	„
Anora	... 155.....	6.24...	„
Hachambetsu ...	... 31.....	1.24...	„
Pangetorata ...	... 18.....	0.78...	„
„ ...	... 22.....	0.88...	„
Wembetsu ...	... 49.....	1.82...	„
Stabetsu	... 43.....	1.80...	„
Tsukubetsu ...	... 72.....	3.00...	„
Ku-o-betsu ...	... 60.....	2.68...	

Name of rivers surveyed.	*No. of Stations occupied.*	*No. of miles surveyed.*	*By whom surveyed.*
Shimamapu	288.....	14.60...	„
Watsu	138.....	8.38...	„
Horumui...	211.....	10.50...	Mr. Matsumoto
Ikushibetsu	—.....	— ...	„

Total number of miles of River work=344.74

„ „ „ Stations= 4,723

In a few general remarks concluding his report, Mr. Wasson alludes to the agricultural and other capabilities of the valley of the Ishcari. This valley below Kamoi Kotan seems to be subject at times to overflows. At different places along the river Aino huts are found. Kawa Kami is the general name of the region above Kamoi Kotan. The great obstacle to the development of this region is the want of a good road leading to it.

The Ishcari above the Horumui, at least, is not a navigable stream. Small vessels, of a draught of not more than four or five feet might go as far as the Sorachi. Beyond that point, however, the river is so broken up into rapids, that it cannot be navigated except by small boats and canoes.

Respecting the triangulation, it is to be regretted that more could not have been done; however, everything is in readiness for next year. Finally it will be seen that as little time as possible has been lost, and that the party has done, in the aggregate, no inconsiderable amount of work.

In conclusion Mr. Wasson expresses his gratification at the spirit and perseverance displayed by the assistants of his party and the satisfactory way in which they did their work. He also calls especial attention to the admirable manner in which Mr. Day performed the work which came under his direction. With a party entirely unacquainted with the work before them and imperfectly supplied with instruments, the position of Mr. Day was one of no little difficulty; sound judgment

and zeal were requisite for its successful completion, and these qualities were possessed to a high degree as his report and charts will abundantly show.

Mr. Arai, too, from his theoretical and practical knowledge of surveying, was able to render a great deal of assistance, and by his kind attentions added no little to the comfort of the party.

VARIOUS LETTERS

ADDRESSED DURING THE YEAR

1874,

TO THE

KAITAKUSHI DEPARTMENT,

BY

HORACE CAPRON,

COMMISSIONER AND ADVISER

TOKEI:
PUPLISHED BY THE KAITAKUSHI.
1874.

CORRESPONDENCE

DURING THE YEAR 1874.

SHIBA, 4th March, 1874.

Gen. HORACE CAPRON.

DEAR SIR :—Wishing to take into consideration the subject of land values, taxes, duties, &c., I beg to ask you to give me an exact view of the arrangements for dealing with those matters, hereinafter mentioned, as there will be certain regulations in the Colonizing Department of the United States of America.

Hoping for an answer for your earliest convenience.

I remain, Sir,

Yours respectfully,

開拓次官黒田清隆

K. KURODA,

Kaitakujikwan.

QUESTIONS.

1.—The manner of determining the value of land, when newly opened for cultivation, having no ground in its vicinity with which to compare it.

2.—The difference in taxation between farm land and building ground.

3.—The proportion of taxations of the business of towns as compared to that of the country.

4.—Rate of taxations with regard to the value of land.

5.—The different degree of land-taxations with regard to the business advantages of the place.

6.—The source of the money to support the public office in the towns or villages. Government or people ?

7.—The difference between the ground of official buildings or the land property held for the transaction of Government business and those of private citizens, in supplying the public expense of a town or a village to which they belong.

8.—The source of the money for the salary of officers in divisions and subdivisions of towns or villages.

9.—The source of the money for repairing the buildings used in transaction of public business, and for other expenditures (stationery, fuel, lights &c.), in such divisions and subdivisions of towns or villages.

10.—The source of the money for printing the public proclamations and for the erecting and repairing of the bulletin boards on which they are posted.

11.—The source of the money for building and repairing the roads, rivers, public waterclosets, &c.

12.—The source of the money for expenses in cases of drowning or sudden death of some homeless person, or of sending the people taken sick on the public road.

13.—The source of the money for the support of foundlings, lost children &c.

14.—The source of salaries for school officers and money for other school expenses.

15.—The source of salaries &c., for police.

16.—The source of wages of firemen, and expense of providing the fire engines, and keeping them in repair.

17.—Any useful information besides that embraced in the above question will greatly oblige.

KAITAKUSHI, TOKEI, JAPAN,
March 10*th*, 1874.

His Excellence,

KURODA KIYOTAKA JIKUWAN.

DEAR SIR,

In reply to the series of questions contained in your communication of the 4th inst, relating to the manner of establishing the price of unoccupied land, mode of taxation, various sources from which revenue may be derived, payment of Government Officials, construction of public works repairing the same &c., &c., as practised in the United States of America; I have to state that there are in the United States, and also in all the European Governments, such a variety of laws bearing upon these subjects, which from the nature of their institutions and general customs differ so materially from those of this country, that it will be very difficult to apply them here. Nevertheless a general view of the Laws and regulations in force in the United States bearing upon your various questions may afford some basis upon which you may frame a code of rules and regulations to meet the requirements of the Kaitakushi for the colonization of the Island of Yesso.

In reference to taxes more particularly, it may be well to state in the beginning that the property of the Government in whatever shape it may be found is never taxed

for the use of the Government. The lands belonging to the General Government, no matter in what State or Territory they may be situated are not liable for taxes until they have passed entirely out of its possession by "patent" issued from the general Land Office, signed by the President of the United States. They are then liable for taxes under the laws of the State or Territory in which they may be situated.

The General Government raises no revenue by *direct taxation*, but derives its revenue from duties collected from the internal trade, commerce and manufactures of the country, and mostly through foreign importation.

These revenue laws are too complex and extensive to admit of any intelligent description in this communication

To give you some idea of the system of Taxation in the United States, it will be necessary to show the various authorities under which revenues are obtained. The first is the General Government, which provides for the payment of the salaries of the President of the United States, his cabinet officers and the many thousands of officials in the various Departments, for the payment of the Members of the Senate and House of Representatives, the expenses of the Army and Navy, the erection of all public buildings throughout the country, including the capital. Department buildings, Custom Houses, General Post Offices, Barracks for Soldiers, Fortifications, Light-houses, improvement of its harbours, interest on the national debt, &c., &c., &c. All of which for the year last past amounted in the aggregate to over three hundred and eighty millions of dollars ($380,000,000.)

To provide for this immense sum, duties are levied and collected as above stated, but no taxes are imposed upon land or the agricultural products of the soil.

The next organizations empowered to levy and collect taxes, are the State authorities, under a Governor, Legis-

lature and various subordinate branches with numerous officials. The revenue for the payment of all these, together with the cost of erecting all public buildings for the use of the state, the improvement of the navigation of its rivers, the construction of its canals within the limits of the state, building of asylums for the insane, deaf, dumb and blind, and the erection of penitentiaries and prisons, for its criminals, keeping of all public property in repair, in fact all other objects demanded for the proper Government of a State, and which are duly provided for by the Laws enacted by the Legislative and executive authorities.

To provide for all this a *direct tax* is authorised upon all land or personal property of whatever nature within its borders, *except the productions of the soil. The farmers' crops are in all cases exempt from taxation.* The system of levying a tax upon the crop, and thus compelling the farmer who by his superior skill and industry increases the capabilities of his land and produces larger crops than his more indolent neighbor, who possesses equal advantages in every respect, and in some cases even greater, appears to me to partake of the nature of a tax upon industry, intelligence and skill, which it should always be the duty of a good Government to foster and protect.

The mode of proceedure in levying and collecting these taxes under the *States' authorities* is pretty uniform throughout the different States. First for every district there is *appointed an appraiser* of property, also, a collector of taxes. The appraiser is furnished with printed schedules, in which is a list of every article taxable under the law, whether it be land, or what is denominated personal property. In this schedule are left blank columns for inserting not only the number of each particular article, but the price, which the appraiser is sworn to do upon strict principles of justice, rating each article

at the regular cash market price of the same in the neighborhood in which the property is found.

This schedule when completed is returned to the proper authorities, who proceed to determine the proper rate of tax necessary to insure sufficient revenue to meet all demands upon the State. From this list regular bills are made out and forwarded to each individual whose name appears upon the schedule, thus notifying him of the amount for which he is liable for taxes. In due time the collector proceeds to collect the rents, which if not paid on demand, the property can be sold at public auction by the sheriff or marshal of the district, to pay the tax, with the addition of all expenses attending the sale, and interest at the rate of 10 per cent. In all cases this tax when once levied becomes a "*lien*" upon the property, and supersedes all other claims of whatever nature, until the tax is paid, and it cannot be avoided by any transfer of the property to a third party.

The third powers properly authorised to levy and collect taxes are the *Municipal Governments*, or city, town and county organizations. In each city, for instance, there is a local government composed of a mayor, a common council and other civil officers, whose duty it is to provide for the security of the person and property of its inhabitants, organize and control the police, open new streets, pave and repair the same, provide for lighting the streets and supplying the city with water, &c., &c. The Police Court under this corporation have the power to bring to trial, and to punish all persons for violation of any of their laws.

The infringement of any law of the State or General Government is tried by a higher court. With all this formidable array of machinery for the levying and collecting of taxes in the United States, the rate of taxation is often less than one per cent and seldom reaches to two

per cent on the market value of the property even in the populous cities. With these general remarks I will proceed to answer as concisely as possible your several questions.

First Question.—"The manner of determining the value of land, when newly opened for cultivation, having "no ground in its vicinity with which to compare it?

Answer.—It has never been the object of the United States Government to derive from the sale of its public domain to new settlers within its borders, beyond what is necessary to defray the expenses for surveying the land and keeping the public records of it, preferring rather to depend upon the ultimate increase of its population and wealth through the augmentation of its taxable property, increase of its commerce and manufactures, &c., from which its revenues are derived. The wisdom of this course is shown in the fact that although the annual expenses of the country have reached the enormous amount of *hundreds of millions of dollars*, yet the rate of taxation upon the regular cash value of its property to produce it, is less than two per cent. For these reasons a merely nominal value is placed upon the public lands under different gradations known as "minimum," "double minimum," "reserved," and "swamp lands."

By the term "reserved lands," is understood such lands as contain minerals, or are contiguous to railroad or water communications and suitable for town or city locations, &c., such lands cannot be located under the Homestead or Preemption Laws, but must be sold to the highest bidder for cash at public auction. These sales are directed from time to time by the Commissioner of the General Land Office and approved by the President of the United States. The lowest price for which these lands are to be sold is stated in the order for sale, and is never placed at specula-

tive prices but always so low as to attract the attention of the immigrant.

(Note.—There have been various modifications of these laws, but not changing the general principles).

"Double Minimum lands" are such as have peculiar claims for soil and timber and are in near proximity to rail-roads, and the price is fixed at two dollars and fifty cents per acre.

"Minimum Lands" are those more remote from settlements and rail-roads and other facilities for carrying produce to market. These are rated at one dollar and twenty five cents per acre.

"Swamp Lands" are such as are marshy and too wet for cultivation.

All of the above named lands except those reserved for public sale, are open to settlers under the Homestead and Preemption laws of the United States, a synopsis of which I furnished the Department, in my Report of January 2nd, 1872.

It is of course understood that these lands have all been previously surveyed, plotted and placed upon the records at the General Land Office at Washington, and duplicate copies of the maps and records are also to be found at the local Land Offices in each district where the lands are situated, for the convenience of reference to the settlers. On the records and maps will also be found complete descriptions of the Land. It will be seen by this, that there are no rules directly applicable to this first question, until the lands of Yesso are first properly surveyed and thrown open for settlement and cultivation. Attempts to establish a price upon lands that have no market value, must necessarily be purely arbitrary, and dependent entirely upon the judgment of the authorities themselves.

Second Question.—"The difference in taxation between farm land and building ground,"

Answer.—If this question refers to a farm with its buildings, barns, dwellings and other permanent improvements upon it, I have to say that buildings and all other improvements upon the land are not taxed separately, but are considered as so much added to the value of the land and are appraised accordingly.

The same may be said in general of all town lots with the buildings upon them ; they are gauged by the market prices for similarly improved property in their immediate vicinity.

Third Question.—"The proportion of taxation of the "business parts of cities or towns as compared to the "country ?"

Answer.—It is presumed that by this question is meant the per centage or rate of taxation, and not the appraised value of property, as there can be no rule by which the comparative values of property in the city and the country, can be determined otherwise than by their actual market value in each case. The *rate of taxation* is another matter. It does not, however, necessarily follow that property situated in the midst of a thriving city should be taxed at a higher rate *per cent* than property located in the country, as its enhanced value is supposed to meet the increased demand upon it without the necessity of increasing the rate per cent of taxation.

Of course there are cases where this rule would not hold good, as where a city emulous of distinction may erect costly monuments and otherwise make unusual outlays which may demand from the city treasury more than the ordinary rate of taxation upon the assessed value of its property would produce.

The first thing to be done in all cases, is to ascertain the full demand upon the treasury, and then upon the appraised value of the property of the city *levy* such a rate of taxation as will produce that amount.

Fourth Question.—"The rate of taxation with regard to the value of the land?" *Answered* in the above.

Fifth Question.—"The different degree of land taxation with regard to business advantages of the place?"

Answer.—This question is also fully answered by the answer to the third question; nevertheless it may not be superfluous to add that the rate or *per centage* of taxation is generally uniform throughout a state, city or town—separately considered, the difference in the value of property generally equalizing the actual tax upon the property holder.

Sixth Question.—"The source of the money to support the public officers in the towns or villages"?

Answer.—All officials appointed by the Government, should be provided for by the Government wherever they may be assigned to duty, but in the absence of any Municipal arrangements in a town or city or village for the protection of its property and inhabitants, the Government is called upon to do it. The city or town should be called upon to pay their portion of the expenses incurred.

Seventh Question.—"The difference between the ground of office buildings, or land property held for the transaction of Government business, and those of private citizens in supplying the public expense of a town or village to which they belong"?

Answer.—In general the establishment of public works or offices for the transaction of public business within a town or village is considered very desirable as it occasions the disbursement of more or less of the Government money and consequently increases the value of real estate. Therefore the property of the *Government* within such town or village ought *not* to be taxed to defray the expenses of the town.

There are cases, however, where streets are to be kept in repair at considerable expense, and much used by

Government teams, &c., so that the Government lands through which such streets pass should be taxed pro rata to defray the expense.

Eighth Question.—"The source of money for the "salary of Officers in divisions and subdivisions of towns "or villages?"

Answer.—The answer to the sixth question will apply to this.

Ninth Question.—"The source of money for repairing "the public buildings used in transacting public business "and for other expenditures, stationery, fuel, lights, &c., "in subdivisions of towns or villages?"

Tenth Question.—"The source of money for printing "the public proclamations, and for the erection and re-"pairing of the bulletin boards on which they are posted."

Eleventh Question.—"The source of the money for "building and repairing roads, fences, public water "closets, &c.

Twelfth Question.—"The source of the money for ex-"penses in cases of drowning or sudden death of homeless "persons, or sending the people taken sick upon the pub-"lic roads?"

Thirteenth Question.—"The source of the money of "the support of foundlings, lost children, &c.?"

Sixteenth Question.—"The sources of wages of fire-"men and expenses of providing the fire engines and "keeping them in repair?"

Answers.—This whole series of questions, it appears to me, can be answered under one general head, but the difficulty in shaping an answer at all satisfactory and to the point lies in the fact that no sufficient information is furnished me in regard to the plans of the Kaitakushi for the Government of the Island of Yesso. If the system heretofore pursued of filling all the positions even to the Police and minor offices of the different cities and towns on the

Island, is to be continued, nothing can be plainer than that the Kaitakushi should provide the ways and means to pay them, and also for the general expenses enumerated in the foregoing questions.

The whole matter would seem to me to resolve itself into the simple problem for the most equitable and practicable method for raising the necessary revenue to maintain a Government of this character.

As you have asked for information upon subjects of land valuations, taxes, duties, payment of various officials and other expenses of a Government as suggested by the laws and customs in the United States for colonization &c. it is obvious how much they will require to be changed and modified to suit the different forms of Government and how difficult it will be to mould any plan from them at all applicable to this present case.

The system of subordinate Governments within a Government like that of the United States down to the Municipal organizations for the protection of life and property in a city or village all working harmoniously under one general system, is much the same in effect as the organization of an army, with its subdivisions of corps, divisions—brigades—regiments and companies, &c. It simplifies and perfects the control and management of the whole.

It will hardly be possible in a communication like this to attempt to go more into detail upon the subject of Government, but what has already been said very strongly suggests the importance of adopting some well-devised system with its proper checks and balances and responsibility to laws, that shall secure the faithful performance of all duties under it.

Question thirteenth.—"The source of the money for "the support of foundlings, lost children, &c."

Answer.—I have selected this question from the several

heretofore considered for the purpose of saying a few words upon charitable institutions in the United States in the hopes that some practical lessons may be drawn from them, and applied in this country for the relief of the suffering poor and unfortunate, who are to be found here as in all other countries and climes.

I confess to ignorance of any well-defined plans for their care in this country, although there are evidences that they do exist here to some extent, and perhaps may be in many respects as effectual as those of our own country; however, it can do harm no to refer to them.

Every city and country in the United States is required by law to provide for its own poor; for this purpose there are buildings erected in all the towns and the people in each district are taxed for their maintenance, but far more is done through charitable gifts and legacies. The institutions built up by these means, aided by contributions from the States and Cities, not only provide for the poor, but the blind, the deaf and dumb, the foundling, in fact for every character of destitution. Many of them are of very great extent, perfect in their every arrangement for the comfort of the afflicted inmates. They form a noticeable feature amongst the institutions which are a credit to the nation.

Question Fourteenth.—"The sources of salaries for "school officers, money for other school expenses?"

Answers.—Until within a late period education in the United States was left entirely with the people, and schools were supported mostly by a district tax for that purpose and buildings were erected in each "School district." In many districts, out of such small beginnings have grown institutions of learning that rank high amongst the kindred institutions throughout the world. These institutions have been built up mostly from bequests and legacies from wealthy individuals. Of late, however, the

General and State Governments have taken the matter of educating the people into their own hands and the old district schools supported by a district tax are less common. A system of Free Schools has been organized, and to day it is within the power of every individual through the whole length and breadth of the land, to acquire a good education free of expense. In fact in many of the States compulsory laws have been enacted, requiring that every child shall receive a certain degree of education. To accumulate a fund for the purpose, the General and State Governments have set aside extensive tracts of valuable lands, the income from which is to form schools for the education of its people. I would most earnestly ask your particular consideration of this system which is now so universally popular in the United States, believing that many of its features are particularly adapted for the people of Japan and would be very popular with them.

Direct taxation is always unpopular and most difficult for the people to become reconciled to, and in this effort to colonize Yesso everything tending to discourage immigration should be studiously avoided, and where so much wealth exists in the natural resources of the Island, in its minerals, timber, fish &c. which only awaits to be properly utilized a sound policy would seem to direct attention particularly to these sources for raising a revenue for the current expenses of this Department.

If, however, taxation is to be resorted to and no municipal organizations recognized through which taxes may be levied and collected, then this Island should be properly districted and Officers appointed throughout these districts for the purpose of levying and collecting these taxes. This can be accomplished through the General Police arrangements if they are properly organized in each district.

It should be made the duty of the Chief Officer in

each district to make an annual estimate for the current expenses of his district for the ensuing year; this should be submitted to the Head of the Department in season for him to give them a thorough inspection, and to see that the proper amounts are provided for before the commencement of the Fiscal Year.

These estimates should exhibit in detail every item of expense for the year, somewhat after the following form. To wit:—

	Dols.	*Cts.*
For the pay of the Chief Officer per annum.....	00	00
„ „ (blank number) of Assistants of 1st class	00	00
„ „ (blank number) of Assistants of 2nd class.....	00	00
„ „ (blank number) Laborers	00	00
„ „ „ Police	00	00
„ pay for constructing roads (mention them)	00	00
„ „ repairs of „ „ „	00	00
„ „ Fuel	00	00
„ „ Lights	00	00
„ „ Stationery	00	00
&c., &c., &c.		

To which should be added a special amount for contingent expenses, or such as are unavoidable and not enumerated in the estimates.

Upon these estimates the appropriations should be based, and to ensure the proper disbursement of the money thus appropriated. Vouchers should be rendered to the Department at least four times in the year—say, on the 31st March, 30th June, 30th of September and 31st of December. And no account should be allowed that did not clearly show that the sums therein stated were for the purpose for which they were originally designed.

The above is merely to give a general idea; of course,

a better digested plan, and one more in detail must precede any action in this direction.

Very Respectfully,
Yours,

HORACE CAPRON,
Commissioner & Adviser.
Kaitakushi.

SAPPORO, YESSO, *June 24th*, 1874.

His Excellency

KURODA KIYOTAKA,
Kaitaku Jiquan.

DEAR SIR,

The lumber interest is so predominant at this time that I propose to lay before you for your consideration some further details in relation to it, before taking up the several subjects to which my attention was directed in your communication of the 23rd April last.

In the first place I will respectfully ask your attention to the present condition of the business at this place, and make a few suggestions for the future prosecution of it here.

There are at present two saw mills in successful operation, capable of turning off—if properly run ten hours each day—twelve thousand feet of lumber. These mills are conveniently arranged for receiving the logs, and discharging the lumber, and are perfect in all their parts. At present they are not worked over six hours each day, and of course are not doing much more than half work, but are kept in fine condition, and well handled by the Japanese workmen when in operation.

There is a large amount of timber cut and delivered at the mills, sufficient for many million feet of lumber, and it will require, at the present rate of working, several years to saw it into lumber, if no more logs should be delivered here. Some of these logs have been cut more than two years, and begin to show signs of decay, and will, from this time on, deteriorate considerably if left in the present condition, but if sawed into plank and "stacked," will greatly appreciate in value, and lessen in weight by seasoning, which of course will greatly lessen the cost of transporting it to market.

There is also erected at this place, a large building filled with valuable machinery driven by water power, for converting this seasoned lumber into any desired form for building houses, railroads, railroad cars, making panneled doors, window sash, tongueing and grooving for floors, making shingles, laths, &c., &c.

Now the great advantages in the use of this series of machinery is, that you can prepare a building complete in all its parts, and send it to Tokei or Yokohama for about the present cost of raw and unseasoned lumber, the saving in the transportation, the difference in the cost of working it by machinery, and convenience in handling, about paying the difference in the two systems of sending this lumber to market.

To show to some extent how this is, I will state, that each of the several parts of a house, for instance, the doors, the window frames and sashes, or any piece of furniture, or car body, are in separate and detached pieces, packed into convenient sized packages, to be put together on their arrival at their place of destination. The separate parts of each door or window sash, all being cut by machinery, are exactly alike in their details, and will fit into their respective places in all. Thus you will perceive that the saving in the transportation in this shape is very great

over rough unseasoned lumber, and to a great extent overcomes the difficulty of getting this lumber to market.

The advantages in having this machinery at this place are numerous.

First.—It is convenient to a large forest of timber, which cannot be approached from any other direction.

Secondly.—It has the advantage of water power to any desired extent.

Thirdly.—It is in the centre of a rich agricultural valley, capable of sustaining a dense population.

Fourthly.—It will give employment to a large number of workmen about the mills, which will in turn create a demand for all articles for domestic use, for food, &c., which will bring together the merchant, the artisan, the farmer, and thus materially aid in building up the place.

These are the immediate benefits, but there are others behind all these. It becomes the school of practice for the whole Island, where all useful foreign ideas are promulgated, and the adaptation of all mechanical appliances —so much desired in this country—for the augmentation of human labor, are practically explained and illustrated, and where specimens of all the various food-plants and fruits from foreign countries will be seen successfully cultivated, and their various uses explained.

I think it well worthy the consideration of the Kaitakushi, whether it would not be better to concentrate—for the present—the greater part of their energy and resources upon this rich valley, trusting to its influence upon the other portions of the Island toward the promotion of its settlement and cultivation.

There are several ways by which this building material may be sent to market from this place. The surveys and soundings made by Lieut. Day last summer have placed the Ishcari route in an entirely new and more favorable

light. There are four different ways of reaching deep water on the Ishcari.

First—by constructing a cheap *tram-way* to the mouth of the Barato, a little over seven miles, to be worked for the present by horse power. On this route there is plenty of timber from which to construct the road, and as the ground descends gradually, and no hills or valleys intervene, a car would probably descend without power.

Second.—A good horse and wagon road over which coolie carts, or horse wagons, or bull teams could be used to great advantage.

Third.—A short wagon road of less than one *ri*—from the mills to a point on the Toyohira river, from which flat boats will take it to the mouth of the Ishcari if desired, or to vessels at the mouth of the Toyohira. This is a very practicable and cheap route, by which this timber can be sent off.

Fourth.—It is possible that the small canal running through this place and into the Shinoro Kawa, may be so improved as to admit the passage through to the Ishcari, of small *sampans* carrying a limited amount of lumber, but in this I would not advise any large expenditure, as I cannot see how a channel narrow and very crooked can be made serviceable, with a fall of (80) eighty feet in about ten miles, and in part of the route it is over twenty (20) feet to the mile. I think it must require the use of *locks*. But as the Kaitakushi officers appear to have confidence in it as a means for transporting this lumber, I hope it may prove a success; if so, it will be a very cheap and direct means for getting this lumber to market.

In regard to the utilization of the lumber from the other parts of the Island, I have to say, that as the transportation of it to market is the only point in which there can be much diversity of opinion, I have duly considered it.

It has always been, and is now, my opinion that communication will sooner or later have to be opened with the Pacific coast, either by railroad or water, for the coal and lumber upon this Island, as it would save the expensive and more dangerous route around the southern point of the Island and through the Straits of Tsugaru. But as this involves the expenditure of large sums of money, it will have to be postponed to some future period.

The possibility of making practicable the route viâ the Ishcari river is now made quite certain by Lieut. Day's report. It was under this conviction that I recommended to your Excellency in my last communication, the placing of mills at the mouth of the Ishcari for working up the great lumber resources of this valley, since this river with its numerous tributaries furnishes the most convenient means of bringing down the logs to that point, where they can be conveniently secured, and taken by the machinery immediately into the mills on one side, and lumber delivered into the holds of vessels on the other.

In reference to the erection of mills at Shin Mororan, I should hesitate to advise it for the present, after having viewed the premises. There can be no doubt, but that at the head waters of Horobets, the Shiraoi, the Usu, &c., there are large forests of valuable timber, but as there is no possibility for a vessel of any size to enter those rivers, or receive the lumber, or the logs, at their mouths, I think it would be more prudent not to attempt to disturb that timber for the present. When the time shall arrive to justify the construction of a railroad from Sapporo and the coal fields on the head waters of the Ishcari to Shin Mororan, it must necessarily cross those streams near their entrance into the Pacific, where mills can be erected, and the timber floated down those streams as in the case of the Ishcari, and the lumber can then be transported cheaply by rail, and deposited into the holds of vessels in the harbour of Endermo.

I have no faith in the proposition to have steamers lying off on that stormy coast, watching for an opportunity to snatch out through that constantly rolling surf, a log, or a raft of logs, to be towed round into the harbour of Mororan. I would recommend that matter to be fully tested before I could advise any heavy expenditure based upon any such calculation.

I enclose an order on the Consul at San Francisco for one hundred and fifty bushels of Oregon seed winter wheat, by order of Governor Matsumoto, which please approve and forward.

Very Respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser, Kaitakushi.

No. 4.

SAPPORO, *June 29th*, 1874.

His Excellency

KURODA KIYOTAKA,

Kaitaku Jikuwan.

DEAR SIR,

In compliance with your instructions under date of 23rd of April last, I called—on my way to this place—at Nanai, and examined the improvements in progress there. The result of my observations were furnished you in my letter of the 24th of May from Hakodate.

I left Hakodate accompanied by Mr. Lyman, and Messrs. Day, Arai and their numerous assistants, en route for this place, where we arrived on the 4th instant. I have now the honour to communicate to you numerous

extracts from my notes on the way, in relation to certain objects to which my particular attention was called by your Excellency.

First the new road for about fifteen miles out from Hakodate, where the soil over which it passes is of clay or rich mould earth, is much cut up by the numerous pack-trains, which have passed over it during the wet weather of the past winter and spring, and it requires repairing. To make this portion of the road good for all seasons of the year, winter as well as summer, it should be "macadamised," or covered with a good coating of gravel or pounded stone. Near the summit of the mountain a cut of the road bed has developed strata of soft rock which can be easily worked, and apparently would make a good road surface, and as this portion of the road is in the worst condition of any part of it, by commencing at this point and working in both directions, this material may be found very convenient for the purpose.

The earth has also settled away from the numerous small bridges over the ditches and drains which cross the road. These places in the road bed should be filled up to a level with the flooring of the bridges: this is a small job.

In other respects the road is in a good condition.

On our arrival at Shin Mororan, we examined the place telected for the saw mill. The only objection I can see so it is its distance from deep water, which will require that all lumber be *lightered* to and from the vessels, but as the capacity of this mill is not more than will be required to supply the immediate wants of the town, I did not think important to advise any change to be made in its location.

On the 29th the weather proving favorable we proceeded up Volcano bay in the steamer Shimbe Maru to a point on the coast opposite the valley of the Mombets (to which my attention was directed in your letter of in-

structions) where we made a landing through the surf without much difficulty, and at this point were met by the officers of the Kaitakushi having charge of the settlements in that valley. Some time was spent in conference upon the various subjects connected therewith, and such advice as I thought best for their future guidance was tendered them. Various seeds were examined and others more suitable and desirable for their cultivation recommended &c., &c. We then mounted the horses which had been prepared for our use and rode through the settlement and on to the old town of Mororan, where the steamer met us and conveyed us across the harbour to the place we left in the morning.

On our ride we passed quite through the thriving farm settlement of the Mombets, which is said to contain a population of over two thousand. The farms appear to be well tilled, and the crops considering the early season for this latitude, remarkably promising. What they most need is a greater variety of a better kind of grains and vegetables,

The soil of this valley although not as fertile as the valley of the Ishcari, is nevertheless good and it is well supplied with water from the surrounding hills from whence it is conveyed through irrigating ditches to every part of the settlement. Wood is also convenient, and sufficient for the immediate wants of the settlements, and the settlement itself has a healthy and improving look.

This valley is quite extensive and capable of sustaining a large population, but it is isolated, and needs roads, and a way for reaching the business marts of the country. It has no roads or way of approach excepting the almost impassable mountain trails. It occurred to me, that if the little steamer which plies back and forth from Mori to Mororan were to make occasional trips to that place, at stated times, when the weather would admit of making a

safe landing, it would give quite an impulse to the settlement, and furnish the means for sending off their surplus productions, and for bringing back their necessary supplies.

Much encouragement may be profitably given to these farm settlements, by a liberal distribution of new seeds, of which they stand in much need, also of fruit trees of which they have none, and of cattle, horses, sheep and swine, of all of which they are destitute, except a few ponies. There is a large accumulation of all of these things at the nurseries and farms of the Kaitakushi at Tokei, which were originally designed for this very purpose. If they were now judiciously distributed amongst these various farm villages, it would enable them to make a good start in their production.

At the present time these farmers have no market for their surplus productions (which being in their nature perishable are not accumulative) they have no incentive to produce anything more than what will simply keep soul and body together. But place it within their power to accumulate wealth, by an annual increase in a valuable stock of horses, cattle, sheep and swine, and to surround their habitations with choice foreign fruits, and embellish them with rare plants and flowers of their own and foreign countries, for which the Japanese have a natural fondness, and you will soon see a different state of things, both in the appearance and character of the country and the people. These things may not be fully appreciated at the present moment, but the time is fast approaching when they will be, and then those who may now profit by this advice and follow it up, will begin to find themselves in possession of unexpected wealth and surrounded with comforts.

The grounds intended for the farm settlements in the vicinity of Shin Mororan were also visited. The hill-

slopes—where not too steep for convenient cultivation, and also the valley-lands are rich and fertile and are well supplied with good water and wood. Their proximity to the new port—which promises at some future period to become a place of importance—together with the advantage of the new road and convenient fisheries, offers many inducements to the settler.

The broad low strip of land at the head of the harbor, opening eastwardly upon the Pacific Ocean is swept by the storms from that direction, which seem to be concentrated in their force at this point as through a funnel, and against the force of which there is no natural barrier. The effects of these storms are seen in the prostrate trees and plants which are bent down and gnarled in their growth. I doubt very much whether crops can be raised there; they will be liable every season to be blown down and destroyed. In fact, I doubt much whether buildings and fences can be made to stand against such a wind, which bores great holes into the very ground. I think the best use that flat could be put to, would be to make summer pastures of it for cattle and horses; it lies too low for profitable cropping and the water is too near the surface for convenient drainage.

During our stay at Shin Mororan, Mr. Lyman and Mr. Day were occupied in examining the country in the line of their duties. Lieut. Day made soundings across the harbor and in the vicinity of the landing, which may be useful in the future, showing the capacity and depth of water to be sufficient to accommodate a great fleet of the largest sized vessels.

The road from Shin Mororan to this place is in good order, with the exception of the crossing of the two rivers, Horobets and Shiraoi, the bridges over which have

both been swept away. These streams like the Toyohira, it will not do to trifle with.

Very Respectfully
Yours,
HORACE CAPRON,
Commissioner and Adviser,
Kaitakushi.

No. 5.

SAPPORO, *July 18th*, 1874.

His Excellency
KURODA KIYOTAKA,
Kaitaku Jiquan.

DEAR SIR,

I have frequent reports from Mr. Lyman of his progress North and East through the Island, the last under date of the 8th instant, near Kamoikotan at the great rapids of the Ishcari.

He had completed the surveys of all the several tributary streams as far up as that point, that is—the Horumui, Ikusubets, Poronai, Ebets, Bibai, Shibets, Sorachi, &c. His surveys thus far have proved conclusively that an immense body of coal underlies that region, probably stretching from coast to coast. This however he will be fully able to determine by this summer's campaign, but the fact that coal is found cropping out in the proper direction on the Western coast, and also that specimens have been picked up on the rivers Sarubets and Shikichari which empty into the Pacific north of Yubuts will probably satisfy him that such is the case.

I make a few extracts from his last letter which may be of interest to you. After giving the result of his various surveys of the several rivers above mentioned, he says of the coal exposed upon the Sorachi—"We stopped and measured the beds of coal and some of the rocks as we went along. The Ainos said there was no coal further up on that stream—but that evening I found some large lumps on the beach a quarter of a mile further up, and the next morning we went on and found still a very fine set of exposures of all the coal beds. Owing to the windings of the river, and the changes of the dip of the coal-beds, they are exposed each two or three times. The beds are very fine as to thickness and some of them as to quality. The thickest coal bed has the enormous thickness of nineteen (19) feet at one place—but not the best quality; at another place, a thickness of thirteen and a-half ($13\frac{1}{2}$) feet of coal; another has eight and seven-tenths ($8\frac{7}{10}$) feet of thickness and the best quality of coal in two places another six feet and six-tenths ($6\frac{6}{10}$) feet and the best quality; besides that there is a bed of four and a-half ($4\frac{1}{2}$) feet, one of four feet and one of three feet and a-half, making six workable beds, and a thickness in them all together of about thirty-six (36) feet. The thickness, however, varies very much at different points. As for quality the appearances are good, but we have taken samples for assaying from the different workable beds."

I have quoted from his very interesting letters, which are too voluminous for me to attempt to copy them entire, but enough has been given to show the very encouraging results of his progress thus far. His letters also contain various remarks upon the character of the country and speculations upon the most feasible routes for transporting this coal to market, all of which will be duly considered in my future reports touching more particularly upon those points.

As I have advised in my previous reports, it will be wise to await his full report before deciding upon the best and most feasible points for attacking this immense coal-field. My own impressions are, and I am sure they are Mr. Lyman's also, that if suitable harbours can be found either on the eastern or western coast for vessels to lie whilst loading, this coal field will be found to approach sufficiently near for all practical purposes to either coast.

On my proposed trip to the eastern coast I shall have an opportunity to observe what facilities there are for a harbour near the mouths of those streams on which coal indications have been found. At the same time Mr. Lyman will extend his survey entirely around the northern extremity of the Island, and down along the western coast, where he will make a thorough inspection of the coal field as it shows itself upon that side, and note the chances offering in the vicinity for forming a harbour. If both of these should fail, we have then to fall back upon the Ishcari route. Although the Sorachi is not navigable for vessels of any size to the point of its intersection with this coal field, yet with a tramway of about 5 *ri*—a depth of water in the Ishcari river can be reached which will be ample for any vessel that can pass the bar at its mouth.

Mr. Lyman thinks that the time necessary for him to reach the mouth of the Tokachi, will be less than was expected, and that the first of August instead of the middle he may be able to arrive there.

Very respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser,

Kaitakushi.

No. 6.

SAPPORO, *July* 21*st*, 1874.

His Excellency,

KURODA KIYOTAKA,

Kaitaku Jiquan.

DEAR SIR,

I have the honor to report the result of my observations made during my late visit to Otarunai and its vicinity, in conformity to instructions embraced in your letter of 3rd of April last, the object of which was—as I understand it—to examine certain localities in that vicinity with reference to their future occupation by the military immigrants, and the adaptation of these lands for farming purposes.

The tracts pointed out to me by the Officers in charge (called Hirorawa and Takashima) lay immediately back of the city, and comprise a series of high hills and intervening valleys, entirely destitute of trees (properly speaking "prairie land") but covered with a heavy growth of coarse grass and weeds indicating great natural fertility in the soil.

The hill sides are generally too steep for profitable cultivation, but the valleys are extremely rich in soil, and the lower slopes of many of the hills, where not too steep, are also quite fertile. These hills being destitute of both wood and water and in many parts too high and too steep for cultivation, may be used for "pasturing" cattle and horses, provided they are allowed free access to water in the streams below, which may be done, by having a "lane" fenced off leading from each enclosed pasture to the water.

To bring the greatest extent of these hill slopes under cultivation, the water in the streams which flow through the valleys, should be led out from the main streams at different points, into canals, which should traverse the hill

sides, taking care to give them a gentle descent to prevent too much abrasion of the banks of these canals by too rapid a current of the water. By this means a very large portion of these side-hills may be profitably cultivated, by throwing the land into terraces and using this water for *irrigation* and other necessary purposes about the dwellings. The habits and customs of the Japanese require a convenient and bountiful supply of pure water, and in no other way can it be obtained on the more elevated portion of these hills. The soil of all this section is naturally rich, but, of course, the lower down on these slopes and into the valleys the richer and more productive will the soil be found

I could form no reliable estimate of the extent of these tracts, but taking in the valleys in their whole extent it is considerable, and with the small allotments generally made to each settler, with the Japanese system of cultivation, they will no doubt sustain a dense population.

Wood in this cold climate being an important item to the farmer, and as he will be compelled to purchase it at the coast and convey it back to his settlement up the valley or upon the hills, it is a matter which should be taken into account by the Kaitakushi, in their allotments to the settlers on these particular tracts. As an off-set to this, however, it may be well to take into consideration also the advantages of near market and convenient fisheries. I was told that a *cube of six feet* (6) *of wood* could be purchased in Otarunai for three *boos* (75 cents), but it cannot be expected that those low prices will rule after the settlement has been fairly commenced.

The next point visited was Asari, a few miles out from Otarunai on the road to Zenibako. This is a small open *prairie* of a few hundred acres in extent, situated upon a high bluff directly on the gulf coast. This small tract is surrounded by mountains or very high hills on all sides

excepting that opening out upon the sea. These hills are generally bare of timber until near to their summits, where a light fringe of timber grows, sufficient perhaps for the wants of this small settlement.

There are two small streams of water, one on either side of this valley which will afford a good supply of pure water. The soil is naturally rich, but has frequent ridges which are very full of stone, which must necessarily be removed before they will be easily cultivated. The near proximity of these lands to the fishing stations and to Otarunai wil recommend it to the settler.

I thought it proper to instruct the officers who accompanied me as to the best methed of disposing of this stone, as practised in the United States and other countries, as they particularly desired me to do, and I here repeat it. The ground is first picked over, and all stone visible upon its surface removed to the borders of the field, there to be built into fences, or they are placed convenient to be used in forming "blind" or under "drains" where required, or they are built into the foundations of the dwellings and outbuildings, and into chimneys. The ground is then dug over to the usual depth of cultivation (or ploughed) and all the stones thus disclosed that are sufficiently large to interfere with the spade or the plough, are thrown to the surface and disposed of as before : if this is thoroughly done in the first workings no further trouble will be found in working this land, and it will probably be found to be the warmest and most productive. This last remark only applies to rich loamy soils encumbered by stone, and not to stiff clay, sandy or barren soils.

On my return to this place I examined the tract near Zenibako called Pan Nari. This is a large extent of flat land lying along the Eastern coast of the Gulf of Strogonof between Zenibako and Ishcari, composed mostly of low sand ridges—or dunes—which have been formed by

the action of the winds and waves and the receding of the sea. This soil although composed mostly of sand, is in many places mixed with vegetable débris brought down by the great Ishcari river and deposited upon this coast by the winds and ocean currents. This gives a consistency to this soil which would make it susceptible of cultivation if aided by irrigation or the liberal use of liquid manures. The evidence of this can be seen in the small garden patches near the fishing stations where these liquid fertilizers have been freely applied.

The surface of this whole tract however lies in alternate ridges and hollows which cannot be irrigated even if water could be obtained, but I saw no streams from which a supply of water for irrigating purposes could be obtained.

I think, therefore, that with the exception of small garden patches near settlements when the liquid manure can be obtained, that it will not be found advisable to locate settlers upon this tract at present,

Very Respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser,

Kaitakushi.

No. 7.

SAPPORO, July 23rd, 1874.

His Excellency

KURODA KIYOTAKA,

Kaitaku Jiquan.

DEAR SIR:

I now continue extracts from letters received from Mr. Lyman since my last to you of the 18th instant upon the same subject. This brings his report up to the 11th instant, and will probably be the last we shall receive

from him until he reaches the mouth of the Tokachi on the eastern coast of the Island. He had returned his canoes down the Ishcari, and was about to cross the mountains to the head waters of Tokachi.

It may be that I am crowding my communications upon you too frequently, but there are so many important questions involved, to which if your attention is directed you will have ample time to consider and dispose of them before the general reports are submitted, that I trust you will consider this is strictly in the line of my duty.

Extract :—"Yesterday, we had no tributary rivers of importance to search for coal bits, though we had from time to time to stop to look at rocks of geological interest, for we are now in the midst of the mountains, and on the last part of the way passed numerous rock exposures. We saw enough to convince me almost that the two groups of rocks I called in my report, the Toshibets Karafto and the Horumui Karafto are one and the same, although there are some singular geological facts connected with the group. If so, the rocks that I took last year to be underneath the Horumui coal are newer, and perhaps cover it in places. Those rocks were almost the only ones we saw yesterday, but on arriving here towards night we found different and older rocks which I have not yet examined closely. Among them, however, is at least a little limestone ; but I have searched all the way up the Ishcari and on the side streams in vain for any pebbles of limestone. On the Sorachi, to be sure, was a little limestone near the coal, in balls, and it seemed so heavy as to be fit for iron ore. It was, however, too little in quantity to be worked, except one four inch seam close under a good coal bed, which could therefore be taken out easily enough. *Iron ore,* indeed, is what now seems most lacking for the future manufacturing prosperity of Yesso, and it is hard to believe that so large an island should not

have it abundantly in some place. As for coal, any body not familiar with such calculations would be astonished to find to what large numbers of tons it counts up. Take, for example, the border of the field from the place of last summer's survey—Poronai—to the Sorachi region, and call it, in all, say twenty miles (eight leagues or *ri)* long, and call the average thickness of the workable beds all together thirty feet or ten yards; and the average height to which the beds extend *above water level,* one hundred and five feet, with an extent therefore along the slope (of say 45°) of fifty yards. Then for every running yard there would be 500 cubic yards, or say tons, of coal above water level, and in a running mile 880,000 tons, and in the 20 miles—17,600,000 tons; and if, as is probable, there be everywhere as at Poronai and Sorachi two rock saddles at least, so that the coal may be found on both sides of each, there would be four outcrops of each bed, and some 70,000,000 tons of coal above water level. If this border of the coal field be, as it may very well turn out, but one side of a field that is also quite as wide, then the whole of the boundary would probably have three or four times as much coal *above water level,* besides what fills up the interior of the field. But so far only the coal above water level has been mentioned; the coal below water level would be as much more for every hundred feet of depth, or in a depth of four thousand feet, (the limit of workable mines as is supposed), there would be forty times as much more. And yet, although we have already got up among the thousands of millions of tons, we have been estimating the probable contents of but *one field* and that not so very large, while the bits of coal in the rivers seem to show that there is another field perhaps as large on the west coast near Rurumoppe, if not much larger reaching northward. If the Kaitakushi should go to work with

might and main at coal mining with the help of a railroad up the east side of the Ishcari to the Sorachi with branch roads into the mountains or with railroads to other points, there is already no danger that it could exhaust its coal resources in centuries. In saying so I take the Horumui (Poronai) coal to be continuous with that of the Sorachi, as is almost certain from the great resemblance of the sections of the rocks at the two places in spite of the thickness of the coal beds on the Sorachi, and as is not at all improbable from the nearness in a straight line, only some fifteen miles (6 ri). The mining need only be limited by the demand, and if good iron ore can be found, the manufacturing of iron would consume an indefinite quantity of coal."

"I think this trip so far has paid very well for its expense and that it promises to do so for the future."

I have quoted quite extensively from Mr. Lyman's last report, because I consider that it settles beyond cavil or dispute the coal question upon this Island.

It now only remains to decide upon the most feasible points for attacking this coal field; the scale of magnitude upon which the work shall be first inaugurated, and the selection of the most feasible and economical route over which to transport it to ship navigation, and thus open up this inexhaustible field of coal to the commerce of the world.

The question of the present and prospective demand for this coal is the only one that cannot well be definitely determined, it must, however, be the controling element in the whole matter. But we will assume that this immense deposit of coal must, with its proximity to the sea-board, its superior quality—if properly developed and managed—greatly influence the eastern markets in this article, and fully justify a very heavy outlay in its incipience. Whether this shall be

done under Government auspices or left to individual enterprise is a question for you to decide; my own impressions favor the latter. In either case it can do no harm to make a few suggestions upon the different channels through which it is proposed to transport this coal to market.

At the present time there are two routes presenting themselves, one by the way of the Ishcari river into the Japan sea, the other by way of the harbour of Endermo or Mororan on the Pacific side.

The only question that can possibly be raised in the choice of the two routes, is the *first cost* or outlay of capital for the construction of roads or canals, &c. In all other respects the advantages of the Mororan route are too apparent to admit of a doubt.

To reach the great coal-field of Horumui from Mororan will require the construction of about—from 80 to 90 miles of railroad—about 60 miles of this may be said to be already graded, if the bed of the road lately constructed from the harbor to Sapporo be used, which with one or two slight alterations and the necessary bridges is well calculated for the purpose.

By this route the coal can be taken immediately from the mines and deposited into the holds of vessels of any size afloat, in a perfectly safe harbor, accessible at all seasons of the year and in all conditions of the weather, and nearer to Tokei and Yokohama by about two hundred and fifty miles than when placed on board ship on the Ishcari river at the termination of the proposed railway.

The advantages and disadvantages of the Ishcari route may be briefly stated as follows. The advantage over the other route is in the shortness of the railroad which will be required to convey it to ship navigation on the Ishcari river, a distance of about 12½ miles.

The disadvantages on the other hand are very great.

First.—The river is closed by ice for nearly one half of the year.

Second.—It will be necessary to construct vessels expressly for this trade, to meet the varied requirements of this route, and to avoid frequent transhipments by ascending the river and receiving their loads at the termination of the railway. For this purpose it is likely that *side wheel* steamers of from five to seven hundred tons burthen will be required, drawing not over nine feet of water, the water on the bar being 12 feet.

Third.—Vessels cannot at all times cross this bar and enter the river, but must anchor off on an exposed coast and await favorable weather.

Fourth.—*Screw* steamers are unsuitable, because they draw too much water in proportion to their tonnage, and would be liable to have their screws twisted off by snags and drift wood in the river.

Fifth.—The coal when deposited in the vessels at the nearest accessible point to this coal field will be about 250 miles further from Tokei and a market than at Mororan.

Sixth.—Only vessels of a certain class and limited capacity can be used on this route, which for long voyages are not profitable or safe for the transportation of coal.

The plan which has frequently been suggested of sending this coal down the Ishcari river in barges, to be transferred to vessels at its mouth, or towed across the Gulf to the harbor of Otarunai there to be shipped or stowed should never be entertained for a moment. The cost of the various transhipments, together with the loss in the abrasion of the coal, will add more to the cost of the coal than it will be worth when it reaches a market.

The above remarks contemplate the development of a great field of operations, having some thousand millions of tons of coal, to back it, which should be able to supply the coal markets of the east if properly developed

and worked. The coal from the greatest fields yet developed in America have to be transported by rail several hundred miles to the sea coast and ship navigation.

How far the further explorations of Mr. Lyman may change the aspect of this coal question, it is impossible to predict, but at present they are all that I have to present for your consideration upon the subject.

With great respect,
I am Sir,
Yours &c.,
HORACE CAPRON,
Commissioner and Adviser,
Kaitakushi.

No. 11.

OFFICE OF THE COMMISSIONER AND ADVISER
OF THE KAITAKUSHI, TOKEI,
September 18th, 1874.

His Excellency
KURODA KIYOTAKA,
Kaitaku Chokan.

DEAR SIR :

In the series of letters that I have had the honor to address to you, whilst on my tour of inspection through the Island of Yesso the past season—under your letter of instructions dated 23rd of April last—also since my return here, I have omitted to speak of the progress of the work and improvements in and around Sapporo. I now beg leave to call your attention to them.

The building erected for the capitol has been completed and is now occupied by the Governor and his suite, and

for the various offices connected with the Kaitakushi. The grounds around it, to the extent of perhaps twenty acres, has been fenced in, and furnished with formidable entrance gates at four points, from which, to the main building, avenues extend; and the main ground is being cultivated in corn (maize) and other foreign grains and vegetables for the purpose of subduing the wild weeds and grasses, when it will be seeded down in the cultivated grasses. The whole space is set out in trees, most of the improved fruits from Europe and America, all of which are thriving. The main building is a sightly edifice, neither too large nor too small for the objects for which it was designed; and is constructed in foreign style, and in a manner creditable to the architect, who has thus broken loose from what may be termed the chronic architecture of Japan.

The large building lately erected for the mills and wood machinery brought from the United States, is probably by this time completed, and the various machines in their places. Everything when I left there was in a state of forwardness; and under Mr Holt's supervision will be sure to operate to the entire satisfaction of the Kaitakushi. It is a matter that I am entirely conversant with in all its details, and I do not hesitate to say that it has been well and judiciously constructed under his directions, and that it cannot fail to prove of inestimable value to the empire as the pioneer establishment of that character, and of great pecuniary benefit to the Department for the development of Yesso.

A number of dwelling-houses have been erected the past year in foreign style as dwellings for the officers of the Kaitakushi, and an experience of one winter has been quite sufficient—I am informed—to convince them of their superior comforts in that climate, over the thin Japanese-built houses. These buildings are well arranged

—flanking the main building—on broad avenues, each enclosed with space enough for the cultivation of vegetables for a family, and for a display of the native taste in ornamental gardening, and the cultivation of foreign fruits. They will greatly aid, by their example, the introduction into the Island of the most desirable food plants.

Governor Matsmoto deserves great credit for the example he is setting within the space encircling his residence. It would be a notable example of high cultivation in any country. If there are any who still remain in doubt of the fertility of the soil, or the salubrity of the climate of that Island, let them visit the Governor, when they will see *corn* and many other *test* crops, equalling in their growth any upon the famous lands in the valleys of the Wabash or the Mississippi rivers in the United States.

The management of the Government farm, I am sorry to say, is not so creditable, although supplied with improved agricultural implements and machinery; with unlimited command of laborers, and and a large force in working animals (17 large horses, 8 well broken bullocks) and a soil of unsurpassed richness, with not a stone or root to impede the working of machinery, yet there are in the United States thousands—yes, tens of thousands—of small farmers with small means at command, who can show better results.

Too much attention is given to the cultivation of the native plants of the country, to the neglect of the more valuable food plants of other countries, for which this farm was originally designed. I can see no particular object to be gained in this, unless some new method, or example of superior cultivation of these crops could be shown, but this is not done; better farming may be seen on most of the small farms in the vicinity. One of two things is important for the success of this farm: either that a good experienced American farmer should be sent there

for at least one year, or some one placed in charge of it who is willing to profit by good advice.

The improvements attempted the past spring on the canal leading through Sapporo, have vastly improved the appearance of the place, but have failed to accomplish the objects most desired from such a work. Had the suggestions contained in my letter to Your Excellency dated at Sapporo, July 22nd, 1872, on this subject been heeded, the present water power would have been doubled, the the city supplied with an abundance of water in case of fires, and also for irrigation and all other desirable purposes, the expensive curbing necessary in the present place avoided, and the actual cost for the work greatly lessened.

I can only express my regrets, that so important a work should have been done without reference to me in any manner, or the advice given to the Kaitakushi in my letter referred to. This work appears to have been executed without any well devised plan, and without any preliminary surveys or levels being made, and in entire ignorance of the first principles of hydraulics—or that branch of engineering which relates to the application of water as a motive power, or the power of water when in rapid motion ; this was made apparent on the first day the water was let into the canal, the defects in which were pointed out to the officers in charge the first time I was asked to look at it.

The levels on the Toyohira river were run by Lieut. Day's party before he left Sapporo for his field work in the general survey. Starting from a point below the bridge and ascending the stream to a point just below, where the upper groins were placed for the protection of its banks—a distance of one ri or more,—the fall was found to be one hundred and fourteen feet, which rapid descent renders this stream at times of heavy freshets a powerful and almost irresistible torrent.

The plan adopted in the construction of these groins—or shields—for the protection of the banks and for turning the current into new channels has not proved sufficient for the purpose, and quite insufficient to resist so powerful a current: they have mostly been toppled over or much shattered by the spring freshets.

The work erected last year at the head of the Kamakura branch, which gave way in the freshet of last fall—referred to in my Report of 1st November 1873—has been repaired and greatly strengthened, and to appearance is a very good work. If the foundation of this work is well secured and deeply laid, and the bank so high as not to be overtopped in times of highest water, (points that I had no opportunity of learning), there will be no danger of its again giving way, and it will prove a good and efficient work.

The plan adopted in the construction of the groins or "break-water" above the new bridge across the Toyohira for the protection of the abutments and for changing the channel in a portion of that stream, will have a severe test, but I feel confident that if the foundations are well and so deeply laid that they cannot be undermined, they will answer the purpose.

I have endeavored to impress the importance of this upon the attention of the Officers in charge, and as Governor Matsmoto fully understands it and is always attentive in such cases, I feel sure a good work will be done there.

In my next I will endeavor to furnish you with the result of my notes taken during my tour to the eastern end of the Island.

Very Respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser,

Kaitakushi.

KAITAKUSHI, TOKEI, September 29, 1874.

His Excellency

KURODA CHOKAN,

Kaitakushi, Tokei,

SIR,—Having thoroughly inspected the works of the Kaitakushi at Sapporo and its vicinity, together with certain points along the coast designated in your letter of instructions of the 23rd April, and having, also, made all necessary memoranda for future reference (which have, in a general way, formed the substance of any late communications,) it was decided on consultation with Governor Matsmoto that I should start on my intended visit along the south-eastern coast of the island, returning thence to Hakodate to embark for Tokei.

On the morning of the 5th of August I left Sapporo accompanied by Mr. Yugee and our guide, servants, &c. I was agreeably surprised on mounting my horse in early morning at finding the Governor and a number of his suite mounted and ready to accompany us quite a distance on our way.

A fatiguing ride of two days, during which we were exposed to the searching rays of the sun and to swarms o flies and mosquitoes, brought us to the sea coast at Yubuts. At this point we met Lieut. Day and party who had just landed through the surf from a small steamer direct from Hakodate. All of the instruments were in perfect order. After much delay Lieut. Day is at length able to push forward with vigor the trigonometrical survey of the island. With an efficient corps of assistants, headed by Mr. Arai, we have every assurance of a satisfactory report of his summer's work.

On the 7th we continued our journey along the coast eastward from Yubuts, crossing the Sarubets and inspecting the small farm settlement on its eastern bank. The Sarubets is a strong mountain stream ; at times it inun

dates most of the valley and much of the settlement itself. I should judge that the location of the place is too low for security in the event of freshets. The soil in this vicinity is of unusual richness, as lands subject to annual overflow generally are, and the weeds are so rank as to interfere with cultivation. Were the buildings and improvements on more elevated ground, the valley could be profitably cultivated, with the risk, perhaps, of an occasional overflow and the consequent loss and damage to crops. Soon after leaving Yubuts, the road rises from the low sandy plain to an elevated terrace of unsurpassed beauty. The bluff fronting the sea is from fifty to sixty and even a hundred feet in height. Seaward the eye sweeps over a vast expanse of ocean, and traces the coast east and west for many miles. Esan, the northern cape at the entrance of the Straits of Tsugaru, and Cape Edomo, the eastern point of Volcano Bay, together with several of the solfataric peaks, loom up in the distance, and unite with the softer features of the landscape to form a scene of varied beauty and grandeur. Inland, stretching to the verge of the horizon, is a vast prairie interspersed with oak openings, with a soil as fertile and an appearance as attractive as any portion of the United States. To this great plain the deer come down from the mountains to cast their young, where they can be protected by the almost impenetrable growth of grass, which overtops horse and rider. I was informed by an officer that at one station near here over 5,000 deer pelts were annually secured. It would be difficult to discover a more attractive place for a settlement than this plateau offers. After crossing the Sarubets Kawa, we passed another dividing ridge, much the same in general appearance and covered with timber, but inferior in the character of its soil. The ravines and gullies reveal substrata of pumice much too near the surface for good farming land. This tract may

however, afford extensive ranges for pasturage, as numerous narrow but rich valleys cross it.

About midday of the 7th we again reached the coast at the Aino village at the mouth of the Asubetskawa. This hamlet contains about 1,500 inhabitants, whose sole occupations are hunting, fishing and collecting seaweed. The Ainos, like the Indians of North America, are content to gather from the wilderness the roots and seeds which nature provides. These, with the seaweed which every storm strews upon the beach, furnish them with vegetable food. They obtain animal food by hunting and fishing, which are to them at once a means of livelihood and enjoyment. The bark of trees and the skins of wild animals shelter and clothe them. It would seem that the same difficulties are to be encountered in efforts to civilize these people which are met in similar attempts with the North American Indians. The Aino, however, possesses more amiable and attractive traits of character than the Indian, and greater capacity to appreciate the advantages of a higher civilization. But in the one case, as in the other, fondness for the chase and for an exciting and almost irresponsible life, with a corresponding distaste for steady and industrious application, is a vis inertia which years of earnest endeavor may not overcome.

On the 8th of August we proceeded along the beach beside a bluff a hundred feet, or more, in height, that prevented us from seeing the country, which is said to be favorable to cultivation where not broken into ridges. We crossed many streams bordered by valleys rich in soil, with a heavy growth of timber back from the sea. During this day's journey we were shut out altogether from the land breeze, while the swarms of flies made our horses almost unmanageable, and the rays of an almost tropical sun and a rising tide, threatening at every step to bar our progress, rendered the day's travel memorable. Our

safe arrival at Nei-ka-pu was made all the more pleasurable by the discovery of a commodious and comfortable honjin on the seashore.

At this point we were met by the managing agent of the great stock farm in the valley of the Neikapu, which stream enters the sea at this place. We ascended its banks a few miles to a beautiful valley where we found a tract of country many miles square fenced with a post and rail fence. This enclosure contains dwellings for the labourers and godowns for the storage of supplies. In anticipation of our visit, the large herd of horses (2,300 head,) had been collected in the corrals. This is a great enterprise and might be made highly profitable and useful by changes in the system, which you will pardon me for suggesting. The custom prevalent in Yesso, as in Mexico and South America (where immense herds of horses are suffered to run wild,) of allowing the stallions to run with the mares without regard to the relative numbers of each, is a bad one. In this instance there are less than two mares to each stallion. One mare coming into heat at the commencement of the season will set the 800 stallions into a regular state of war, kicking, biting and striking, until the strongest gets the mastery. This is kept up throughout the whole season of two or three months, when at last the stallions are reduced in flesh, scarred and maimed and many killed outright. This may be avoided, to a great extent, by lessening the number of stallions. In this case 200 stallions would be sufficient, provided the best and most vigorous animals were selected. This course would ensure more colts and save the expense of keeping 600 horses; besides, it is the only way in which your horses can be improved, by selecting the best to breed from. If in the number there were included a few good Nambu stallions, so much the better.

This matter is well worth the attention of the Kaitak-

ushi: I was informed that shortly before my arrival 300 horses had been sold at $8 per head. A few years' careful breeding would produce stock worth as much or more in the southern market than the Nambu horses. Three hundred colts from a herd of 1,400 mares is a small increase, and is due, no doubt, to the excitement and worry kept up in the herd during the period of gestation. With careful management the increase should have been at least 1000 head.

I learned with surprise and gratification one fact in connection with this enterprise, viz: that it is not necessary to provide the stock with winter food or shelter, but that they run at large throughout the season, feeding upon the lowland grasses in the summer and upon the bamboo grasses, which grow thickly upon the surrounding hills, in the winter, and that they are in good condition in the spring. I know of no part of the middle or northern portions of the United States where this could be done. It certainly places beyond doubt the position I have always maintained with reference to the climate of Yesso, and should be sufficient to stop all further caviling on the subject.

On the 9th we left the comfortable honjin at Neikapu, and proceeded four miles along the coast to the river Chihikari, in the valley of which is a flourishing farm settlement. We were escorted about the settlement by Mr. Namyugi and a number of gentlemen connected with the enterprise. The whole settlement bears evidence of the fact it is under the management of a higher order of Japanese. After inspecting the various farms we were conducted to the government house, where we were entertained at a collation such as no one could reasonably expect to find in that part of the world. A few hours were agreeably spent in conversation upon the development of the island, its general resources, the proper me-

thods of cultivation, the improvements necessary, &c., &c. I encouraged them in the hope that I would use every effort to induce the Kaitakushi to deal liberally with the various settlements of the island. My best endeavors were employed to stimulate a feeling of enterprise and to encourage the hope of a successful future.

Taking leave of these gentlemen, we continued our journey along the coast to Mombets, where we stopped for the night. On the following day, the 10th, leaving Mombets at 5 a.m., we arrived at Meitsu Ichi at 7.30 a.m., riding through a heavy drift from the sea the whole distance. This part of the road, like that on our journey the previous day, follows the beach below the cliffs against which the sea beats at high tide. Great care is required to avoid being caught by the tide betweeen the projecting bluffs, and with all our precautions we were at one time compelled to take to the bluffs to avoid the swell. In many places it will be difficult to construct a road along the coast, as it must be cut either in the cliffs, above the reach of the surge, or back from the coast across the ridges and ravines which are at right angles to the coast. A survey, however, may reveal a more practicable route than any we were able to see from our line of travel.

The Government house, or honjin, at Meitsu Ichi, like the one at Nei-ka-pu, deserves especial note. They are both models of neatness and order, and present pleasing contrasts to the other habitations along this desolate coast.

At the crossing of the Meitsu Ichikawa we stopped to examine an establishment for the production of silkworm eggs and the preparation of the cartons. The building itself is of the most primitive character; it is one story in height and about 16 by 25 feet in width. There were about a dozen persons employed in the business, and the annual yield was reported to be 700 cartons. The worm

feeds upon the mulberry which I have found growing in every part of Yesso I have visited.

Our journey along the coast boyond this point was exciting and oftentimes perilous. The beach is seamed with ravines and with the courses of mountain streams rushing into the sea and meeting the surge, which rolls in with an almost deafening roar. This road is by no means safe or pleasant for travel, and I earnestly recommend that a reconnoissance be had by a competent engineer to discover, if possible, a practicable route for the construction of a road parallel with the coast, if it is intended by the Department to push forward settlements in that direction. Uragawa is the only point I have seen along the whole coast from the harbour of Mororan eastward to Yorimo Juki the south-eastern point of Yesso, where there is a possibility for a vessel to approach nearer the shore than from one to two miles. It was an agreeable surprise, therefore, as we approached this place to discover several tall masts looming up directly inshore, and to see on nearer approach several large junks at anchor in a small cove protected from the waves by a projecting reef. The surf breaks over this reef, but it is never entirely submerged, except in a gale. The soundings here show a depth of 25 feet, with a clear passage from the southwest. Judging by the eye, I should say that a heavy sea wall about 300 yards in length would ensure a safe anchorage for a large number of vessels. This matter is important, as a harbor is not only necessary for the accommodation of the fisheries, but also in view of the fact that Mr. Lyman's surveys will probably develop an extensive coal field in the vicinity, of the existence of which there are many indications. I have requested Lieut. Day to make an examination of the place and to report upon its adaptability to the proposed uses. I have also requested him to determine by observation the true position of Cape

Yorimo, which is said to be placed on the maps and charts some thirty miles too far south, a very considerable error to navigators, which he will be able to correct. The farm settlement on the Horobets Kori (there are several rivers of this name on the coast), was reached after a ride of 3½ miles along the coast, and a fatiguing ride of about an hour up the river, through mud and mire and amidst dense clouds of mosquitoes. Passing through a thick growth of timber we emerged in a cleared space where the settlement is situated. To one experienced in the effects of the combination of causes to be found here, it is not a matter of surprise to witness the disastrous result of all attempted crops. The wheat and rye were entirely destroyed by rust, and vegetables and corn were choked out by a rank growth of weeds. The Japanese hemp, which thrives in this rich soil and humid atmosphere, was the only crop which gave promise of remunerative return. The dark mildewed soil and the murky air are certainly not conducive to the successful growth of cereals. The policy of attempting to force settlement beyond the reach of every necessity and convenience of life, and to places where even Nature's freest gift, good fresh air, is denied, I cannot understand. If, as was suggested by one of the Japanese officers, it be from fear that if the more desirable lands are first occupied it will be difficult to induce the settlement of those more remote and inaccessible, it is a great mistake and must operate to retard immigration to Yesso. Nothing could be more detrimental to the work of the Kaitakushi than the reports which must go back from these people to their friends and relatives in other parts of Japan. If the settlement had been commenced nearer the coast, upon lands more elevated and accessible, but with a soil equally rich, the results would, beyond doubt, be encouraging, instead of demoralizing and disheartening, as at pre-

sent. The result of the present policy is depicted in the countenances and is evident in the condition of the settlers, and in the absence of everything which could make home comfortable or a people happy.

In my next communication I shall have some suggestions to offer in regard to the future policy to be pursued with reference to these settlements, and I trust that they will be received, as they are offered, in a spirit of kindliness and with an earnest hope for the advancement of the true interests of this Department and the Government.

Very Respectfully Yours,

HORACE CAPRON,

Commissioner and Adviser, Kaitakshi.

REPORT

OF THE

TRIGONOMETRICAL SURVEY

OF THE

ISLAND OF HOKKAIDO

BY

MURRAY S. DAY.

Lieut. U. S. N. and Surveyor-in-Chief, Kaitakushi.

TOKIO,

1874.

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TOKIO, JAPAN, December 10th, 1874.

General HORACE CAPRON,

Commissioner and Adviser

to the Kaitakushi.

SIR :—I have the honor to submit the following preliminary report of the progress of the survey of the Island of Hokkaido, made during the present year.

Before giving an account of the work accomplished by the several parties, however, I desire to make a statement of the different details made, and why so made.

On reaching Sapporo in June, and after making the necessary adjustments of the instruments, the following parties were organized, and assignments of duty made.

The first, under the charge of Mr. Nozawa, and Mr. Takemura to assist, was instructed to complete the work on the Chitose river and its tributaries ; the survey of this river having been carried last year, as far as the mouth of the Shimamapu river. After which they were to make a survey of the Tokachi river and its tributaries, and if time would permit, were to cross over to the head waters of the Ishikari, and work down that river to the Aibets, the point to which Mr. Wasson carried his work last year.

The second, in the charge of Mr. Nagai, and Mr. Matsmoto to assist, was to commence at the western end of the Base Line, near Yubutsu, and to establish the location of the coast line, working to the eastward; and was also instructed to survey all rivers met with on the coast.

The third party, comprising Messrs. Nasa and Midzuno, was assigned similar work, commencing at Yubutsu, and to work down the coast towards Volcano Bay.

The fourth party, in the charge of Mr. Seki, and assisted by Mr. Terazawa, was instructed to erect the necessary signals on the mountains selected, suitable for the trigonometrical work which was to follow.

The survey of farm lands having been placed under my direction, in co-operation with General Otori, I instructed Mr. Mizoguchi in the use of the solar compass, and the method of the division of lands, in order that he might survey such sections of the island as would be selected by General Otori.

In the mean time, I proposed to commence the work on the Base Line at Yubutsu, with the assistance of Mr. Arai, Mr. Hirabiashi, the Paymaster of the party, and Mr. Uyeda, my interpreter.

The adoption of this plan of work was not strictly in accordance with the system generally observed in similar surveys, where the tertiary and topographical work follow the principal triangulation; but as we had not yet received the necessary instruments for the triangulation, I decided on this as being the best plan to follow out. And in order that the work of the different parties might hereafter be connected with the triangulation, I instructed the gentlemen in charge of them to place substantial signals every ten or fifteen miles apart on their lines, which will be occupied again, and will serve to correct the work done by them.

The following will show the work accomplished by the different parties during the season.

Survey of the Toyohira River. Previous to commencing the work assigned to the various parties, and while collecting the coolies and material necessary for the purpose, I directed the gentlemen to make a survey of the Toyohira River, in the vicinity of Sapporo, in order to show the relative position of the old and new river beds, the fall of the river in this vicinity, and the engineering work done last year. This work was conducted principally by Messrs. Seki and Nagai; the map already furnished you will best show the results.

Survey of the Chitose River.—On the 18th of June Mr. Nozawa, with his party, moved to the mouth of the Shimamapu River, the point to which this work was carried last season: but owing to the immense fall of rain, and the consequent freshets, he was unable to commence the work at this time; the stake he wished to occupy being *two feet under water*, notwithstanding that its position last Fall, relative to the river, was, on a bank four feet above the water level. This necessitated a delay in the work till the 21st of July, when the rivers had subsided to their normal condition: and in the mean time these gentlemen assisted in the preliminary measurement of the Base Line.

The Chitose flows from a lake of the same name, which is in the bed of a large extinct volcano. The party was unable to carry the work quite to the lake, owing to the extremely rough character of the country, which they describe as being impassable, and especially so with instruments.

The river, flowing through deep mountain gorges, is a succession of rapids and water-falls for the first five miles, after which the fall is more gradual and regular. The survey was completed to this point, after which Mr. No-

żawa, with an Aino guide, succeeded in reaching the lake. He describes it as being a large and irregular sheet of water, surrounded on all sides by steep mountains which are thickly wooded to the water's edge. He was informed by the Ainos that the distance round the shore of it was fourteen *ri*, or about thirty-five miles, but as Ainos generally judge of distances by the time it takes to travel them, which, of course, depends on the character of the country passed through, their statement in this case is liable to considerable error.

The following statistics will show the work accomplished by this party:

Miles surveyed on the Chitose river	38
Angles measured	861
Fall, in feet, (from last stake to mouth of the Shimamapu)	375
Miles surveyed on Izari River (tributary to the Chitose	15
Angles measured	313
Fall, in feet	280
Miles surveyed on Mo-izari (tributary of the Izari)	2½
Angles measured	63
Fall, in feet	48
Miles surveyed, Osatsu creek (tributary to the Chitose)	2
Angles measured	18
Fall, in feet	21
Miles surveyed, Sechi-izari creek (tributary to the Chitose)	1
Angles measured	8
Fall, in feet	2
Miles surveyed, Chitose swamp	6½
Angles measured	142
Miles surveyed, Mamachi creek (tributary to the Chitose)	2

Angles measured..... 42
Fall, in feet 40

This work occupied the party till the 8th of September, when I found it advisable not to attempt the survey of the Tokachi river, as it was then quite late in the season; and owing to the sickness of Mr. Seki, I deemed it of more importance that Mr. Nozawa should take his place in establishing the signals. And Mr. Takemura was enabled to render very great assistance to the party occupied in measuring the Base Line.

Survey of the Coast Line.—As before mentioned, this was assigned to the two parties under the charge of Assistant Nagai and Nasa respectively. Not till the 23rd of June, however, were they enabled to commence their work, owing to the almost incessant fall of rain, which, in fact, has been a serious drawback to the work of all the parties during the season.

Their initial stake was driven on the right bank of the Yubutsu River, at its mouth; from which, Mr. Nozawa's party—after completing the survey of the Yubutsu River and its tributaries to the lake of the same name, connected its work with the monument at the western end of the Base Line, and then worked along the coast to the westward.

An idea of the accuracy of the surveys made by these gentlemen, as well as those of Mr. Nozawa, may be gained from the following general description of the instruments used, and method employed.

Each party was provided with a surveyor's transit (manufactured by Queen & Co., of Philadelphia). In adapting these instruments to this kind of work last year, we found it necessary to supply the diaphragms, which hold the cross-hairs, with two additional horizontal hairs, in order that the instruments might be used with telemeter rods in measuring distances. These

rods were marked similar to those used by the U. S. Coast survey in connection with the plane table, and were made of such a length as would enable the observer to read a distance of 300 metres with perfect distinctness. And, in order to introduce a check on the distances measured, we have, this year, used two rods instead of one; the second rod being used in taking the back sights, with the sharp edge towards the observer when determining the angles; and with the graduated surface, or face, in obtaining the second reading of distances. Each rod was also divided into feet and tenths, similar to the ordinary leveling-rod, though on the opposite surface (or back) from that used in measuring distance. So that with the instrument and rods the observer was enabled to measure angles, distances and level readings. As a check on the angles the assistants were instructed to take compass readings every ten stakes.

The following statistics will show the progress made by Mr. Nagai :—

Miles of coast line surveyed.....	93½
Angles measured 1012	
Number of rivers surveyed.....	39
Miles of rivers surveyed.....	148
Angles measured on rivers.....1946	

This embraces that portion of the coast between Yubutsu and the mouth of the Utabetsu River, which is about five miles from Erimo Point. Generally speaking, the survey of the rivers extends to the foot range of mountains.

The following statistics are those of Mr. Nasa's party :

Miles of coast line surveyed.....	61½
Angles measured.....	771
Number of rivers and creeks surveyed...	50
Miles of „ „ „ „ ...	112
Angles measured „ „ „ ...	1,681

This embraces that part of the coast from Yubutsu to Volcano Bay, and, including the shore line of the bay of Tokaramoi, extends to a point some distance beyond old Mororan.

While at Tokaramoi Mr. Nasa, besides making a survey of the town, also surveyed and staked out lots for a new town, on the flat neck of land just outside of the present town.

Measurement of the Base Line.—The site for the Base Line was selected by my predecessor, Mr. Wasson, and the towers or signals, erected which mark the ends. It is located on the low flat ground on the east coast, between Yubutsu and Mukawa. The western station or initial point being directly back of Yubutsu, the approximate geographical position of which is Lat. 42° 37′ 24″ N., Long. 141° 45′ E.; and from which the approximate magnetic bearing of the station at the other end is S. 64° E.

The preliminary measurement was commenced on the 22nd of June by my party and completed on the 27th: using for the purpose a wire sixty metres in length and one-eighth of an inch in diameter.

Messrs. Nozawa and Takemura were employed in laying out the line with surveyor's transit, while Mr. Arai, assisted by Messrs. Hirabiashi and Uyeda, conducted the measurement, all however under my general superintendence. The result of this measurement gives the approximate length of the base line as 14,868.72 metres, or 9.23 statute miles.

Owing to the delay in forwarding the necessary instruments from Tokio, we were unable to commence the accurate measurement till the 12th of August. Mr. Arai, assisted by Messrs. Hirabiashi and Uyeda with the rods, and Mr. Fukusi with the aligning transit, conducted the work throughout, and in a manner that reflects great credit upon him,

In this measurement we used the apparatus which was constructed in Washington under the direction of Professor J. E. Hilgard, of the U. S. Coast Survey. It consists of two iron rods, each four metres in length and five-sixteenths of an inch in diameter, and each incased in a solid wooden bar which is three inches wide and six inches deep. The ends of the iron rods are mounted with agate bearings, one being a plain surface, and the other is of a wedge shape, which is called the "abutting end." The rod has a lateral movement in the wooden case by means of a tangent screw, which motion is counteracted by a spiral spring, the abutting end having an index attached in such a manner as to show when the contact is perfected.

Each bar is furnished with a thermometer which is imbedded in the wooden case in such a manner as to bring the bulb nearly in contact with the iron rod, so that the temperature may be read at any time without removing the thermometer.

There is also attached to each bar, a level sector, for reading the inclination. There are six tripods with trestle mountings used for the bars to rest on, when conducting the measurement, each bar being supported by two, and the third pair being placed always in advance, and at the proper distance so as to receive the shifting bar, which is advanced from the rear for alignment and contact.

The apparatus is also furnished with a third rod, called the standard, as well as a comparator. The standard being four metres in length, with an uncertainty of 0m.000,004, taken at the temperature of melting ice. The two measuring rods having very nearly the same length, are compared with the standard for each base-line measurement, and a correction of 0m.0,000,257 is allowed for each degree of temperature above that of melting ice. (For a full description and drawing of this apparatus, see

Appendix No. 45 to the U. S. Coast Survey Report of 1857).

The measurement was completed on the 21st of September. The actual time occupied, however, being thirty days; bad weather frequently delaying the progress of the work.

I am unable at the present time to furnish you with the results of this measurement, as the corrections for temperature and inclination have not yet been calculated. Moreover, the comparator and standard rod were not forwarded to us in the field, so that we were obliged to bring the measuring apparatus to Tokio in order to make these comparisons, which will occupy some little time, so that the accurate length of the Base Line has not yet been determined.

Astronomical Observations.

After completing the preliminary measurement of the Base Line the latter part of June, and the instruments for the accurate measurement not having arrived, I started with my party, consisting of Mr. Arai, my interpreter and the paymaster, and on the 2nd of July reached Hakodate, where I fully expected to find the instruments. Not till the 14th of July, however, did the first instalment arrive, consisting of one 10-inch theodolite—one portable astronomical transit instrument, the base measuring apparatus and one chronometer.

Through some misunderstanding, or otherwise, in the Department in Tokio, the box containing books and manuscript relating to the measuring apparatus, was not forwarded with the first instalment, so that further delay in Hakodate was necessary. In the mean time, I was kept busy in rating the chronometer. After having had a portable observatory and pier built for the transit instrument, we commenced the transit observation of stars, but owing to the unfavorable weather, were unable to get

a sufficient number on which to rely for determining the rate. Fortunately, however, we were favored with clear weather during the day time, so that we succeeded in getting over four hundred equal altitude observations of the sun, between the 21st of July and 5th of August.

On the 25th of July I received the box of books together with a siderial chronometer and a heliotrope ; and having obtained the use of another chronometer belonging to the Hakodate Department, I embarked with my party and the instruments, on board the steamer "Kome Maru," on the morning of the 5th of August, and reached Yubuts on the 6th. Bad weather prevented the commencement of work till the 12th, when, as before stated, the accurate measurement of the Base Line was commenced.

Soon after this I commenced the observations with the transit for the determination of the latitude and longitude of the Yubutsu station, and continued them until the latter part of September, during which time I had but comparatively few clear nights for observing.

For a want of a proper catalogue of stars I was unable to get very satisfactory results for latitude, which as at present determined, depends upon the observations made on different nights, of fourteen pairs of zenith star, while the longitude depends on ninety-two observations of thirty-five stars, taken on different nights, and with five chronometers—(I having received shortly after my return to Yubutsu, two more chronometers from Hakodate.)

Besides the above, I made seventy-two observations on Polaris near its eastern elongation, for determining the astronomical bearing of the Base-Line, (using the transit instrument for this purpose), in connection with seventy-two observations made the following month by Mr. Seki, with the 10-inch theodolite, for determining the angular distance between the "light-box" and the Mukawa station.

None of these observations have yet been worked up, the accurate results from which will be submitted with the annal report which will be completed during the winter.

While on my way down the coast in October, I made observations with the transit for determining the latitude and longitude of Tokaramoi (or Endermo Harbor, as it is marked on many of the charts). And on reaching Hakodate the latter part of the same month, I verified the errors and rates of the chronometers by the transit of thirty-five stars, taking observations three nights apart.

Trigonometrical Stations. The work of erecting signals necessary for the triangulation progressed very slowly at first, owing to the great difficulty met with by Mr. Seki, in finding a suitable site for the first station. He occupied several of the most prominent peaks of the foot range of mountains which extend back from the coast in a northerly direction; and not till the early part of September was he successful in establishing this station so that it could be seen from both ends of the Base-Line; and even then his men were obliged to cut down some two or three hundred large trees in order to obtain a clear view. This signal is on, what is called by the Ainos, Domoni mountain (or hill). Its approximate position relative to the eastern end of the Base-Line, (which will be known in the survey as the "Mukawa station") is,—magnetic bearing N. 16° E., and distant about eight miles; and has an elevation of five hundred feet above the sea level.

The next signal built by Mr. Seki is on Shiabira mountain, which has an elevation of 950 feet above the sea-level, and is distant about eleven miles from Domoni signal, and bears from it (magnetic) N. 12° 30′ E. It required considerable time to open this signal to view from the western end of the Base Line, (which we call the

Yubutsu station), and from Domoni signal, as the party found it necessary to clear the top of the mountain of trees. This completed, Mr. Seki returned to my camp on the 22nd of September, and as he was too sick to continue this work, I detailed Mr. Nozawa to do it, with instructions to erect a signal on Mombets mountain, which he succeeded in doing, though with no little difficulty as its sides are covered with ragged volcanic rocks which demand considerable caution in climbing. This signal has an elevation of 2,600 feet above the sea, and bears from the Yubutsu station N. 51° W. (magnetic) and distant about twenty miles from it, while its position relative to Shiabira station is mag. bearing S. 87° 30′ W. and distant about twenty-eight miles from it. With the signals on these three mountains (Domoni, Shiabira and Mombets) we can work back from the base line, and will have a very good quadrilateral included.

After completing the Mombets signal, Mr. Nozawa continued his work by placing a signal on the top of Maoi mountain, which being further to the North, is to the east of the Chitose valley. From this station (as well as Mombets) the dome of the capitol at Sapporo is visible, and forms a very good triangle. Then follows the signal on Asoiwa mountain, which completes the chain of triangles across the Island to the Japan sea.

Triangulation. After the measurement of the Base Line was finished, I started Mr. Fukusi with the triangulation. He commenced his work the latter part of September, by first occupying the Mukawa station. After a detention of two weeks by bad weather he succeeded in getting the requisite number of measurements of the angles at this station; and then occupied Domoni station with similar success. He completed his season's work by occupying Shiabira station, and then returned to Hakodate.

In the mean time Mr. Seki was engaged in similar

work at the Yubutsu station. I have not yet examined the work of these two gentlemen, but will venture to say that it is as accurate as any work their instruments will give, as they are both very careful and accurate observers and thoroughly understand the requirements in this class of work. They used the two 10-inch theodolites which were manufactured in Washington for this Department; and in conducting the work, have carried out my instruction with great care.

Survey of the Anchorage of Urahawa. In accordance with your wishes Mr. Arai and I proceeded to Urakawa, the early part of October, and made a rough survey of the anchorage at that place. The accompanying chart will perhaps best show the results of our work. In this we were assisted by Messrs. Takemura, Hirabiashi and Uyeda.

This anchorage lies between two reefs which extend out from the shore in a westerly direction: the general trend of the land in the immediate vicinity being nearly North and South. The southern reef, being the largest, is about 550 yards in length and from one hundred to two hundred yards in width near the shore, a greater part of it being exposed at low water. The northern reef is smaller and more irregular. The anchorage, with an average depth of 14 feet, is about two cables in width and of about the same length.

The southern reef offers very good shelter from the ordinary South-east weather which prevails during the summer season. But there is no protection against the strong West and North-west gales which blow during the winter season, and drive a fearful sea in on to the coast.

Were a breakwater built on the southern reef it would make a very safe anchorage for junks and small vessels, during the summer season. This could easily be done, and with proper management, at a moderate expense, as

there is close at hand an abundance of rock which could be easily quarried for the purpose.

In connection with this subject I desire to call attention to the extremely dangerous character of this section of the coast.

Between Horobets and Yubutsu the coast is generally speaking low and sandy; but after passing Yubutsu and Mukawa, high cliffs are met with, close to water's edge, with still higher ground in rear, presenting to the mariner the appearance of a bold coast; whereas, in reality, it is a succession of reefs which stretch out some four or five miles from the shore, making it very dangerous for coasting; so that until the actual extent of these reefs is known, it would be advisable for vessels not to cruise closer than ten miles to the coast.

Survey of farm lands.—I regret that the attempt to systematise the survey of farm lands has not been successful. The plans of work, at first adopted, were (unknown to me) changed soon after Mr. Mizoguchi took the field; so that instead of making a rectangular survey of those sections of the Island selected by the proper authorities, he was directed by them to make a general topographical reconnaissance; which he has done. The following will show the results of his work.

Near the road to Otaru, and distant about four miles from Sapporo, his survey covers an area of 601,060 *tsubos*, or about 500 acres. This place is called Kotonimura. After finishing this, he made a similar survey at Tainemura, which adjoins Kotonimura, where his work covers an area of 959,136 *tsubos*, or about 792 acres. He was then instructed to survey the country in the vicinity of Makomonai and Misomatsusu two small settlements on the new road to Usu, and distant about ten miles from Sapporo.

This survey embraced an area of 1,152,630 *tsubos*,

or about 952½ acres. From this place he moved to Izari, which is on the Chitose road, and distant about seventeen miles from Sapporo.

This work covers an area of 1,769,468 *tsubos*, or about 1,462 acres.

He has made rough maps of his work, in the field, and during the winter I will submit to the Department finished maps, which I hope will show, with sufficient accuracy, the character of the country selected for the location of the military colonists.

In reviewing this hasty report it will be seen that all of the parties belonging to the survey, have made considerable, and I hope, satisfactory progress with the work entrusted to them. Most of the young gentlemen of the survey having had a tolerably good mathematical education, and one year's practise in the use of instruments in the field, I felt assured that they were competent to conduct the work assigned to them, and I have not been disappointed in my expectations. Mr. Arai, who was associated with me last year in my work on the Ishikari River, has been the main-stay of the party. The kind and willing manner in which he has assisted in carrying out my plans and wishes connected with the survey, has added greatly to our success.

The strength of the party was considerably increased by the addition to it of Mr. Fukusi, to whom, from his practical knowledge and natural taste for surveying, was assigned the duty of commencing the triangulation. Besides this, he has kept a faithful meteorological record during the summer, which I regret to be unable to append to this report, as he has not yet arrived from Hakodate.

In conclusion, I deem it not out of place that I should give a general idea of the plans of work I am desirous of

carrying out next year, should I remain in charge of the survey.

It will be seen that we have fairly commenced the triangulation, having measured the Base Line, and established signals for the chain of triangles which extend across the Island. As it is desirable that the triangulation should be pushed forward as rapidly as possible, I propose starting three parties, early in the season, to erect the necessary signals; these will be followed by the three triangulation parties, one to work south from the valley of Sapporo towards Hakodate. As the southern section of the Island is quite narrow, the work of this party ought to extend from coast to coast.

The second party, to work a chain of triangles to the north, keeping to the west coast; and the third party to do the same on the east coast. In this manner we hope to accomplish the triangulation of the most important portion of the Island; and when this is completed, it will be desirable to put the three parties to work to complete the triangulation of the central part of the Island.

After starting these parties on their work, I propose to make a geographical reconnaissance of the Island; starting from the mouth of the Ishikari river, and following the west coast to the northward, and returning by the east coast With the portable transit, which is especially adapted for this work, and the six chronometers which we have, I desire to determine the geographical position of points on the coast, about thirty miles apart; and at the same time, to have other parties fill in the coast line between my stations, with surveyor's transits and telemeter rods. In this manner we shall be enabled to get an accurate outline of the Island; which is certainly very desirable for immediate use, as we have not at present a very well determined coast line of the Island.

This will keep all of the gentlemen of the party em-

ployed during the year, when, the following year, the triangulation, having been sufficiently advanced, the entire force can be put to work on the secondary, tertiary, and topographical surveys, as required in the different sections of the Island.

Very respectfully,

Your obedient servant,

MURRAY S. DAY,

Lieut. U. S.N. and Surveyor-in-Chief,

Kaitakushi of Hokkaido.

REPORT

OF A

BOTANICAL JOURNEY

IN YESSO,

IN 1874,

BY

LOUIS BÖHMER.

TOKIO:
PUBLISHED BY THE KAITAKUSHI
1875.

SHIBA, December 24, 1874.

General HORACE CAPRON,

Commissioner and Adviser
to the Kaitakushi.

SIR:—In compliance with your instructions to investigate as far as possible the *Flora* of Hokkaido, I started for that island during the latter part of May, and reached Hakodate on the 21st day of that month. Having returned to Tokio at the end of October I now beg to submit to you the first part of my report:

1.—Itinerary of my journey.

2.—General observations on the *Flora* of Hokkaido.

In order to complete the report it will be necessary to make an enumeration of all the living and dried plants collected, but this can only be done when they have been carefully determined according to botanical works and existing collections and will take some time.

My journey, I am sorry to say, was undertaken too late in the season to collect all the specimens which would illustrate the vegetation; and should a complete *Herbarium* and collection of living plants be required it would be necessary to start as early as March, when, working from

the south of the island to either coast, a more successful exploration could be made. I have made a collection of more than one hundred and twenty different living plants, that they are now planting at the experimental farm, and a large collection of about 500 dried specimens under preparation, which will be arranged according to their natural orders, and as far as possible determined. I have thought best not to mention at present many of the Japanese names of the plants, because most of those that were given to me have since proved to be incorrect.

Itinerary.

Itinerary of my journey from Hakodate to Sapporo, thence to the east coast as far as Akkeshi and back to Tokarumui and from there by steamer to Hakodate.

May 21, Arrived at Hakodate. From there

					Ri.	*Miles.*
July	4, to Nanai			...	9	22½
„	9, to Mori		Volcano Bay	...	7	17½
„	10, to Yamukushinai		„	...	6	15
„	11, to Kuroiwa		„	...	4½	12
„	12, to Oshamambe		„	...	5	12½
„	13, to Kuromatsunai		Interior	...	6	15
„	15, via Otashuts to Esoya		West coast	...	6½	16½
„	17, to Iwanai,	per boat	„	...	4	10
„	18, to Tomari,	„	„	...	4	10
„	19, to Furuu,	„	„	...	4	10
„	22, to Shakotan,	„	„	...	9	22½
„	24, to Furubira,	„	„	...	6	15
„	26, to Yoichi,	„	„	...	5	12½
„	27, to Otarunai,	per horse	„	...	6	15
„	28, to Sapporo		Interior	...	9	22½
Aug.	5, to Josankei		„	...	8	20
„	10, back to Sapporo		„	...	8	20
„	10, to Shimamappu		„	...	5½	14½
„	15, to Chitose		„	...	4	10

			Ri.	Miles.
Aug. 17, to Yubuts	East coast	...	7	17½
„ 20, to Saru	„	...	8½	21¼
„ 23, to Shitsunai	„	...	10	25
„ 24, to Uragawa	„	...	8	20
„ 25, to Samani	„	...	3½	8¾
„ 26, to Horoidzumi	„	...	6¾	17
„ 27, to Biro-o	„	...	12½	34
„ 29, to Berufune	„	...	5	12½
„ 30, to Ohotsunai	„	...	8½	21¼
„ 31, to Shirauuka	„	...	12	30
Sept. 2, to Kusuri	„	...	7¼	18
„ 3, to Chipuran	„	...	9½	23¾
„ 4, to Akkeshi	„	...	4	10½
Returned from Akkeshi by the same road.				
„ 8, to Kombumori	East coast	...	10½	26
„ 9, to Shirauuka	„	...	10¾	27
„ 10, to Ohotsunai	„	...	12	30
„ 11, to Biro-o	„	...	13½	34
„ 12, to Horoidzumi	„	...	12⅔	32
„ 13, to Samani	„	...	6¾	17
„ 16, to Shitsunai	„	...	12½	30
„ 20, to Saru	„	...	10	25
„ 21, to Yubuts	„	...	8½	21
„ 24, to Chitose	Interior	...	7	17½
„ 26, to Sapporo	„	...	9	22½
Oct. 1, via Shinoro to Ischcari	West coast	...	7	17½
„ 5, returned to Sapporo	Interior	...	7	17½
„ 9, to Shimamappu	„	...	5½	14
„ 10, to Chitose	„	...	4½	11¼
„ 11, to Tomakomai	East coast	...	7	17½
„ 13, to Shira-oi	„	...	5½	14
„ 14, to Horobets	„	...	7	17½
„ 15, to Tokarumui (or Shin Mororan)	„	...	5	12¾
„ 19, to Hakodate, per steamer *Emperor*,				

GENERAL OBSERVATIONS ON THE *FLORA* OF HOKKAIDO.

On my arrival at Hakodate in the end of May I at once proceeded to investigate the neighbouring districts. The weather, however, proved so unfavorable that I was for some time unable to collect specimens.

The first plants that struck me as most remarkable were the Azaleas and Dievillias which were growing on Hakodate Head in great profusion and with their pink and scarlet flowers produced a magnificent effect. Amongst other flowering trees and shrubs I observed more particularly the common pear (Pyrus communis) the double flowering wild cherry (Prunus Pseudo-Cerasus), a wild Plum (Prunus) and a shrub looking like a wild apple, (Japanese, *Yamanashi*), which I afterwards found to produce clusters of small red fruit, very likely a Crataegus. Of the latter a great number were collected at the time (although I recommended that this operation should be deferred until the proper season for removal had arrived,) and in consequence nearly the whole of them perished.

Another most remarkable climbing shrub the "*kokuwa*," a species of Actinidia, I found in flower on an excursion to Hakodate Head, the only time I saw it in that condition; unfortunately the specimens which I then collected were lost through the inclemency of the weather. I was fortunate enough to secure afterwards specimens in fruit which I preserved carefully. In the Appendix 3 I refer more fully to this valuable fruit.

The only large timber trees I saw were Cryptomeria Japonica, evidently planted there, and the absence of all native timber trees, with the exception of a few small oaks, struck me as very remarkable.

Among the herbaceous plants I must mention Glaucidium palmatum a beautiful Ranunculaceous plant also found in the mountains of Nikko, and never yet introduced

into foreign gardens. The lily-of-the-valley, covering many acres of meadows, was the most charming sight I ever beheld. I also found in the hills several varieties of Solomon's seal (Polygonatum). In some places where water collects frequently I found a fine Arum bearing flowers more than twelve inches long, resembling the Calla Aethiopica but of larger size, which would form a valuable acquisition for our ponds in America; as it will no doubt prove hardy there, because I found it growing in company with the Caltha palustris, a plant which is so very common in our northern latitudes. For many of the spring plants which make their appearance soon after the snow leaves the ground I was too late, or else no doubt I should have had a rich harvest. I remarked some good looking grasses in the neighborhood of Hakodate, but as they were not in flower at that time, I had no opportunity of ascertaining their value for the purpose of feeding cattle, horses, etc. The small white clover is seen growing in many places, not however, I think indigenous, but probably escaped from cultivation during former attempts to introduce foreign farming into the island of Yesso.

Ferns are very abundant on the hills, and amongst them I remarked as growing very luxuriantly the Adiantum pedatum, a kind of Maiden-hair fern commonly grown with us in hot-houses. It is seen in large patches under the shade of shrubs, the effect when young and producing pink fronds on black stalks, is very pretty. Asplenium, Polypodium and Pteris are also abundant.

In seaweeds the bay of Hakodate is very rich and I secured a good collection during my stay there. They are now in course of preparation by the students at the farm.

Nanai, the farm of the Kaitakushi within 10 miles of Hakodate, I visited for several days on my journey to the

west coast. Here I saw the first good-sized trees, although not frequent. They consisted of horse-chestnut, edible chestnut, walnut, magnolias, beautifully leaved maples (Acer palmatum), alder, birch and an ash. There is no remarkable vegetation on the road to Nanai. The farm itself presents no features of any consequence beyond the fine range of buildings for the purpose of stockbreeding, and I found very little to repay my researches there. The few thousand fruit-trees planted there seemed to do better than those I had seen growing in Hakodate, and are as yet free from the attacks of the butterflies, which are so disastrous to the trees in the latter locality. The orchard and nursery are not planned as well as they might be, but only a radical change in the laying out could remedy this defect.

On my way to Volcano Bay going through the mountains at an elevation of about 1000 feet above the level of the sea, I found a beautiful climbing shrub called by the Japanese *Matabi*, which I recognized as Actinidia polygama. At first sight the points of the leaves appear to represent the flowers and are often mistaken for them by casual observers. On close inspection, however, the flowers are under the branches resembling those of the tea shrub. They are sweet scented and belong to the same family as tea and Camellia. The appearance of the shrub is elegant and would well repay introduction into our shrubberies. It is more frequently found growing in company with and climbing on Magnolia hypoleuca, which grows there to a size of two to three feet in diameter and to the height of at least sixty feet. A very remarkable tree, and valued much for the timber it yields, is the Japanese *Katsura*, the scientific name of which is Cercidiphyllum Japonicum, only lately classified under the family of Magnoliaceæ. There are recorded two species in this country of which I only found one. It grows to a large

size and attains a height of over a hundred feet, with a diameter measuring sometimes six to eight feet. The vegetation becomes more dense in the mountains, presenting no new feature, but, descending towards Volcano-Bay, the growth of the trees gradually diminished on account of the pumice of the extinct volcano Komangadake. My destination being Sapporo, and the road skirting the sea-shore at first, little of interest occurred in the way of plants as far as Oshamambe, from where again entering the interior the vegetation was more profuse, caused by the increase of the depth of the soil and the neighbourhood of fresh water ponds which counteracts the fatal influence of sea-air. In the ponds a diminutive water-lily (Nymphaea tetragona) is found, the undeveloped leaf-buds of which are considered a great delicacy by the Japanese and eaten by them with vinegar. The leaf-buds present a peculiar appearance being covered with a mucilage resembling fish spawn. The flowers are white like a small Nymphæa. Leaving the seashore we struck and followed the valley towards Kuromatsunai. The valley is remarkable for its rich growth of plants, maple, alder, chestnut, deciduous oak and ash forming the principal timber trees; less frequent are birch, elm and Aralia. The undergrowth is composed of a close growing Arundinaria, which is commonly called bamboo grass and gives a favorite food for horses and deer. Amongst climbing shrubs I more particularly remarked the magnificent Schizophragma hydrangoides, which I do not think has as yet been introduced into foreign gardens, but which I dare to point out as one of the future leading novelties for our parks. The general appearance of this creeper is striking, and with its white sterile flowers resembles much a white Clematis at a distance, although it is a true Hydrangea; the rich green tint of its foliage is one of its great attractions. Among other climbing plants I found Evonymus radicans, a plant now well known, which cover-

ed the trunks of trees in the same manner as Ivy and is evergreen like its rival. Taxus cuspidata is frequently found in shady places and is the only Conifer growing in these districts. The soil here is black mould, the substratum of which is a dark brown loam.

The Japanese had several settlements here and seemed to do well. They cultivated various grains and vegetables, especially wheat, which grows here of superior quality; barley, millet and buckwheat are also produced in small quantities but must be remunerative to the grower as their general appearance leaves an impression of their doing well. Lilium Thunbergianum was here cultivated to a great extent in company with Dioscorea Batatas for the sake of their edible bulbous roots. The settlers are all Japanese; very few Ainos are met with here, but these do not represent a fair type of these singular people, as they are entirely dependant on the good will of the Japanese settlers. Their huts and their way of living cannot be compared in any way with those of the same tribe, living at what may be considered their headquarters.

On the pretty stream on which Kuromatsunai is situated I found on the stones a singular lily, which is new to cultivation, named by Professor Gray Lilium medeoloides from the collections in 1862. It is a singular lily and resembles much a Fritillaria; and is called by the Japanese *Kuruma Yuri* on account of its leaves being verticillate; *Kuruma* wheel, *Yuri*, lily. It bears flowers, generally single, with petals much recurved of a scarlet color. There was nothing of any marked interest beyond what I had observed hitherto until I reached Otashuts excepting magnificent trees of Magnolia hypoleuca, which being in flower presented a beautiful appearance.

The formation of the ground from Otashuts by Iwanai and Tomari to Otarunai seems to me not very favorable for agricultural purposes if I may judge from the general

vegetation. At Iwanai there is a plain of some extent, but even there, although the position of the ground seems to be favorable, nothing but plants growing on a soil of a poor description could be seen such as Pteris aquilina (brake fern), a few shrubby oaks and others. The young shoots of the Brake fern (Jap. *warabi)* are much prized by the natives as an article of food, the fronds are gathered when still undeveloped and used in soups etc.

It struck me that sheep would thrive well in this valley, as I have seen similar grounds used for that purpose in the north of Germany at a latitude of about the same degree.

At Tomari, going up to the coal mine at Kayanoma, I discovered the Hydrangea spicata, remarkable in its appearance on account of the large spikes of white flowers entirely different from any Hydrangea I ever saw; another Hydrangea I fell in with was of a beautiful sky-blue color, not shrubby like the former, and of a much smaller size, growing in shady situations. It is as far as I can ascertain the Hydrangea acuminata of Siebold and Zuccerini. Among the rocks I observed two different kinds of clubmoss, growing side by side, like those well known in America and always used by the bouquet makers of New York and other large towns in the United States. A fern called Lomaria Japonica is frequent here, and makes a very pretty effect with its variously and delicately tinted fronds; they consist of the sterile ones growing close to the ground eight or ten in number, out of the centre of which two or three fertile fronds rise perpendicularly.

Shakotan is a place famous for the production of a peculiar kind of bamboo (Arundinaria) used by the Japanese for stems of pipes and writing brushes. The place where the reeds grow is situated five miles up the stream from the village. It grows abundantly round the stream, and no traveller who stops at this place

leaves without securing some of the peculiarly colored reeds. The coloring, the Japanese frequently declare, to be characters of their own language, written, as they pretend, by their gods.

In the hills near Otarunai there is a fern growing with variegated fronds. Variegated fronds among ferns are very unusual, especally in northern latitudes.

At Sapporo, which I reached the 28th of July, I remained for about two weeks. As it is the capital of the island I thought it important to gain a knowledge of the plants and trees, which are more frequently to be met with there. The town is situated in a large plain under a range of mountains, and the soil consists of a deep yellow loam covered in most places with about a foot of rich black mould, which I had no doubt, judging from the vegetation, might be easily worked to produce rich crops of grains, fruits and vegetables.

The forest trees principally consist of large elms which have much the appearance of the Ulmus campestris so very common in the north of Europe. This tree attains a large size, averaging about four feet in diameter, and is most valuable for building purposes. A large area is covered with decidous oak consisting of Quercus serrata, a narrow serrated-leaved species ; the beautifully leaved Quercus dentata, whose leaves generally are five to six inches wide ; the acorn, which is always single is enclosed in a hairy cup much resembling some of the north American species ; and another species which has a much smaller and sharper dentated leaf. The third kind bears leaves of middle size and more deeply dentated than those of the former ones. The proportion in size and the number of trees seen growing seems to be equal in all three. A large ash growing about 100 feet high is a striking feature. I further remarked numbers of a large walnut, which cut up into boards is used for the inside of

houses where it produces a good effect. On the foot of the mountains the large Magnolias and Cercidiphyllum already mentioned grow abundantly and in good-sized specimens. A curious tree of a smooth white bark, bearing racemes of flowers almost the size of the elder flower is a gigantic representative in this country of the snow ball family, Viburnum phlebotrichium. Sophora Japonica, in company with another tree resembling very much a Syringa, were in flower at the time of my visit, and I was fortunate enough to secure both living and dried specimens of them, which in some cases were difficult to obtain from other trees.

At a distance of about twenty miles from the capital, having ascended the mountain range, I found an elm with smooth bark and tripinnate leaves, very remarkable on account of the use to which the Ainos (the natives of the island) put the bark, and it is called by them Ohiyo. After being stripped from the tree the bark is thrown into water, and the strong fibre, which separates after some time from the bark, is made into strings and woven into a kind of cloth which is in general use with them. For the purpose of dyeing this cloth they have been ingenious enough to discover materials in other plants. A yellow dye is furnished by the cork-like bark of a tree resembling an Ash (Aino name: *Chikerepeni).* The bark of an Alder (Aino name: *Keni)* furnishes them another dye, which is of a red color. There are three kinds of Birch, the bark of two of which is employed for domestic purposes, one used as torches (Aino name: *Chitachini)* the other (Aino name: *Karibani)* for fastening together boards of boats. Two kinds of Linden are very conspicuous among forest trees. One a large heart-shaped-leaved one is Tilia cordifolia; the other smaller, with flowers more erect, is Tilia mandschurica. The inner bark of both is used for making strong ropes. (Aino name: *Nibeshe ni).*

It is equally used by Ainos and Japanese. Coniferous trees only grow in the higher elevations. They consist of two kinds "Yesso Matsu," (Abies Yesoensis), and "Todo Matsu" another long leaved Abies with a white bark, growing taller than the former, and much used for timber in the sawmill of Sapporo. On the borders of streams I noticed three different kinds of shrubby Viburnum growing in great abundance.

A large lily of peculiar appearance forms together with the Lilium giganteum a separate section of this genus, as it differs from other lilies. It is frequently found near water and in swampy places around Sapporo. It bears large heart-shaped leaves of a dark green color, and its flower stalks very often attain a height of ten feet and more, bearing large flowers of a greenish white color outside; the inside is pure white with purple spots at the base of each petal. It seems to differ from other lilies in propagating solely from seed. My observations in this respect were confirmed by my Japanese companions, who, I have reason to believe, possessed some knowledge of vegetable life. It flowers only after the bulbs have attained a considerable size, from three to four years; and when it has done flowering it dies with the stock. According to Siebold's Flora Japonica, Tabula 14, it is Lilium cordifolium. Siebold hardly can have had an opportunity of having seen this lily in its native habitat, or his figure would have been of much larger dimensions. I also noticed several handsome herbaceous Spiraeas, one bearing red berries, which when ripe turn black; another I found with white flowers about six feet high. Here also grows in the grass, under the shade of trees, a Campanulacea of climbing habit with flowers resembling a diminutive Cobaea: "Campanumaea lanceolata." In the mountains I found a number of terrestrial Orchids, Cypripedium, Epipactis, Liparis and other small

evidently interesting species. In ferns the woods abound, and more particularly I was struck with a large smooth-leaved Scolopendrium. A climbing Hydrangea, the Schizophragma, the Ampelopsis a kind of Virginian creeper, and Vitis labrusca, the wild grape as well as Actinidia with edible fruit (*Kokuwa*) are here frequently met with.

From Sapporo I started for the east coast on the 14th of August. The road leads through a well-wooded country skirting the foot of a range of hills. All along the road, and wherever horses have been travelling, I noticed an herb very common in these latitudes, a Plantago. The seeds of this Plantain if boiled form a mucilage which has been found to act as a remedy in cases of dysentery. The forest trees principally consist of Maple trees of which I noticed and collected three kinds. One of them resembles the American Sugar Maple, and attempts have been made with some success to produce sugar from them. I saw crude samples of it during my stay at the capital, but have no doubt that with proper manipulation it could be made available for domestic purposes. Another of them is remarkable for its curious leaves, resembling more a Crataegus than a maple ; and, if it had not been in flower, I should have mistaken it for one. It never attains more than twenty-five feet in height and one foot in diameter.

From Shimamappu descending gradually towards Chitose the formation of the ground changes from the rich loam hitherto met with into a mixture of black soil and pumice of an extinct volcano. As the soil changes the vegetation also presents different appearances. Deciduous oak trees form the principal feature on the more elevated ground. The mistletoe is found growing abundantly on these trees. The lower ground sloping towards the rivers is occupied by a shrub resembling at first sight a wild apple. It bears red fruit and is called

by the Japanese "*Yamanashi*" Pyrus toringo of Siebold. I found an excellent engraving of it in the "*Kwawi*" a celebrated Japanese botanical work published a hundred years ago. Among plants of smaller growth I noticed several kinds of Spiraea which were in flower at the time and a shrubby Aralia, with small green flowers and black berries. Three terrestrial Orchids are found growing in the grass under the shade of forest trees. One, the universally known Spiranthes australis, a pretty Liparis, and another peculiar looking orchid with large leaves and flowers, probably a Bletia. Shallow ponds of some extent are formed in the woods, and possess a vegetation of their own. Rushes and small ferns and the blue flowering Pontederia cordata are the principal occupants of these moist localities. The deeper ponds are covered with the leaves of Nymphaea tetragona already noticed before at Oshamambe. Birch and Alder are found of all sizes in the more rugged localities.

Leaving the forest towards Yubuts we struck several rivers running in an easterly direction and found large numbers of the Lilium tigrinum the bulbs of which are a favourite vegetable with Japanese. A Lychnis with much laciniated petals and of a bright red color grows here among the grass; it looked so handsome that I collected a number of living plants. Yubuts is situated on the sea shore and vegetation naturally becomes less varied. A large leaved creeping Rubus (Raspberry), bearing clusters of large red fruit, grows everywhere in the neighbourhood. The fruit at first sight looks very tempting, but has little flavor to recommend its cultivation.

Following the coast on our way to Akkeshi I found little of interest until I reached Saru. The sandy levels on the seashore are frequently covered with a wild rose: Rosa rugosa. It has large dark green leaves and single purple flowers, measuring three inches in diameter,

and bears a red round fruit which is much relished by Ainos and Japanese. If preserved in sugar they would make a fine dessert fruit. Vitis labrusca, the wild grape, is also found growing near the seashore. It has large dark green leaves which are of light brown color underneath, and bears bunches of fruit which are dark blue when ripe. The growth of the vine is not as luxuriant as it is in the woods near Sapporo and other places, but this can be accounted for by the soil which here is of a much poorer description. Small oaks with an undergrowth of Lespedeza (a leguminous plant much prized by the Japanese and often mentioned in their poems under the name of Hagi), and a grass Eulalia Japonica growing about five feet high together with an Artemisia are all I remarked. The latter three are cut together and made into hay which is used by the natives feeding their horses in winter. A pretty looking fern is growing on the branches of the oak trees.

Near Saru is one of the head-quarters of the Ainos, consisting of seven villages with a population of about five hundred inhabitants. Their occupation is principally fishing and hunting; but I found some traces of agriculture, or rather garden culture, along the banks of the river on the good rich soil. Millet and beans formed the principal crops. Wild hops grow frequently in this soil; the specimens I saw looked very much like foreign ones, and I think would improve by cultivation. Foreign hops imported there would certainly succeed well if the Ainos could be induced after proper instruction to devote themselves to this profitable article of commerce. Of all the localities I have seen during my stay in Hokkaido none seems in my opinion more favorable to the cultivation of hardy foreign fruit as far as both position and soil are concerned.

I was much surprised to find even in this remote locali-

ty some small traces of ornamental gardening. These gardens are only found at the government stations and planted by officials in former years. The plants consisted principally of those growing in the neighbouring mountains such as Rhododendron, small firs, and the dwarf growing Taxus cuspidata which is often trained into different shapes. In some of these gardens I even found some of the favorite trees imported from Yedo, the plum, cherry, pine, cryptomeria and among herbaceous plants the chrysanthemum was most conspicuous.

On the road to Urakawa I met with an apparently leafless Orchid. It had pink flowers at the time, but I could not ascertain from my travelling companions whether it ever made leaves nor could I find any traces of them. At the same place I found a number of lilies which were pointed out to me as the "black lily" unfortunately the flower had already passed and I had no opportunity of identifying this plant. Mr. Lyman who started earlier for the east coast had seen it in flower and tells me that the flower is of a dark blue color. The plant which generally goes under the name of "black lily" in Yedo, and of which I have seen drawings, differs materially in the structure of the leaves and I am inclined to think that the Yesso lily is a species as yet unknown. I therefore collected a large number of bulbs to be sent to Yedo in order to see whether it really is a novelty or not.

Here I had to leave behind the artist who had been attached to our expedition; he fell sick and had to return; a great disappointment to me as I had counted upon him to preserve in drawings such plants as I was unable to preserve by drying. I am all the more sorry as he gave proofs of considerable ability.

From there the road becomes almost impassable for travellers on horseback. It is nothing but a path and never seems to have been laid out or repaired properly.

and even becomes dangerous in some parts. Gradually ascending the mountains at Samani the vegetation becomes Alpine, and coniferous trees which I had to my great surprise seen very little of up to this time formed the forest to a great extent. Abies Yezoënsis with a pine which I believe to be Larix Kaempferi, but which for want of cones I could not well determine. The undergrowth was formed of a large leaved Rhododendron, and Zanthoxylon, the fruit of the latter is used by Japanese as a medicine. The seeds have a peculiar flavor.

In the moss underneath the fir trees a small Orchid, a Goodyera, is found growing; also the handsome creeping blue Crawfordia (Gentianeae) is to be met here in the clearings. Monotropa uniflora, a species of Ericaceae, is found growing here among stones near rapid flowing streams under the shade of trees. It is parasitical on the roots of trees, has a scaly stem about eight inches high bearing only one flower of a whitish pink color. It resembles much a Monotropa which grows in North America and is called there commonly "Indian pipe." It is very curious that the Japanese also have a similar name for it, viz.: "*Gankubiso*" meaning herb like the bowl of a pipe.

Descending towards the sea shore a pink and a white Scabiosa, in company with a Platycodon, (campanulaceae) is growing in sunny places. Approaching the vicinity of the sea beach the rocks are studded here and there with a small Compositea of which the flowers are sometimes red and sometimes white. I also noticed several different kinds of Sedum and Saxifraga.

From here we ascended again the mountains where I found some trees I had not seen before. Foremost among them is Styrax Obassia a tree peculiar to the Japanese islands with large round leaves and clusters of fine white flowers. It grows about 15 feet high and has a smooth light red bark. A Carpinus with flowers like those of a

Hop almost three inches long was in full bloom. Kalopanax ricinifolium (Miq:) a large species of Aralia which is often found in the forest attains here its greatest size. It is a handsome tree, especially when in flower, and has almost a tropical appearance. The trunk sometimes has a diameter of from three to four feet, and as the wood is easily worked it is used for various purposes, especially by Ainos for their canoes, which are made by hollowing out a portion of a trunk about 20 feet long. The Japanese name is *Sennoki* or *Harigiri*; the Ainos call it "*Yoshini.*" Clerodendron trichotomum, a shrub with large leaves and racemes of white flowers relieved by a red calyx, grows here with great vigor, although I did not expect to find it so far north. It is really a handsome shrub, and would form a valuable addition to foreign parks as it is perfectly hardy here. A pink flowering Andromeda (Tripteleia paniculata), which I had not seen before, grows in patches in stony ground. A pretty flowering herbaceous plant with blue flowers, which I believe to be a Lysimachia, frequently occurs here; and the beautiful Primula Japonica I found for the first time in its wild state on the sides of small mountain streams. Four years ago this plant was introduced into England, and on account of its elegant habit has spread through foreign gardens with great rapidity, and promises to be one of the leading plants for open air cultivation. The mountains rise here to about 3,000 feet, and those facing the sea are generally scantily supplied with vegetation while those more inland are covered with thick forest up to their summit. On the former birch and alder of small size are met with and also small oak. A species of Arundinaria, a favorite food of the deer, covers large spaces of the open ground. The deer are said to collect here in large numbers during the winter season, and are killed by the natives for the sake of their skins. I was informed that no less than 30,000

deer were killed last winter at Horoidzumi, where large plains covered with this reed occur.

Following the road we had again to descend to the seashore, and on the way we passed through most luxuriant vegetation. There must be a considerable amount of moisture in this neighborhood, as I found no less than three different ferns growing on trees. Hydrangea, Actinidia, Evonymus and the wild grape grow luxuriantly, and give the forest almost a subtropical appearance.

From Berufune to Kusuri the road leads through a plain about a hundred feet above the level of the sea. This plain is much intersected by small rivers on the banks of which a gigantic umbelliferour plant was in flower, a species of Angelica similar in habit to those found so frequently in Siberia. They often attain a height of 15 feet with a hollow stem of about 6 inches in diameter; some of the white umbels measured 18 inches across. Apparently it has a preference for moist localities as I only found it growing in places where water is abundant. It is the largest representative of this widely spread family that I have ever seen. Polygonum cuspidatum is frequently met growing in company with these umbelliferous plants. It is a beautiful species of tall growth, whose fertile flowers, which are of a light pink color and produced in large clusters, have a very good effect and would form a valuable addition to park scenery in Europe or America. It sometimes grows to a height of ten feet, and the stems are often used by Ainos as walking sticks, probably because they are hollow, light and comparatively strong. This plant belongs to the buckwheat family, another remarkable instance of the size herbaceous plants sometimes attain to under favorable circumstances. The plains contain very little of interest excepting a number of vigorously growing Aconitum, the roots of which are used by the Ainos for poisoning their arrows in

order to kill wild beasts. They make a decoction of the root, and soak in it their arrowheads, which they use in traps for catching bear and deer. Gentiana Buergeri, which grows sometimes to the height of three feet, is very frequent and has a magnificent effect with its clusters of blue flowers.

At Ohotsunai two small Vacciniums, one with red the other with black berries, occur abundantly. A greenish white Lichen grows between them of which the deer are said to be fond in winter. Several rivers run here into the sea and the plains through which they run would afford good opportunity for cultivation. The soil is a rich loam and of a dark-brownish colour. The black lily mentioned grows at Kusuri in quite large quantities.

From here to Akkeshi the road leads through mountains of not very great elevation. The deciduous trees give way here to conifers. They were represented by the *Todo* and the *Yeso Matsu* before mentioned, with an undergrowth of Taxus cuspidata called by the Ainos "*Unco.*" It is held in great estimation by them as they use the tough wood for making their bows. A great deal of moisture must collect in these districts as a white Lichen is met with everywhere hanging from the trees. Here I found a wild raspberry and a red-currant covered with fruit, of which the bears are said to be very fond. The raspberries favorably compare with those cultivated in foreign countries. The currant grows about ten feet high, has large leaves, and bears large red fruit which is rather sour. A shrub which I think to be Philadelphus coronarius was past flowering and I only saw it in fruit, and was therefore doubtful as to its identity. An Actinidia with red leaves which seems to differ materially from the two kinds already mentioned I only met in this neighborhood.

Around Akkeshi, on the foot of the hills a Rubus, re-

sembling a blackberry, except in the color of its fruit, which is red, grows among the shrubs. The flavor although sweet leaves a bitter taste in the mouth. Wild strawberries grow abundantly here, and are said to be of fine flavor. As they were past bearing on my arrival I had no opportunity of testing their merits. The leaves look much like those of the European wild strawberry.

Opposite Akkeshi there are two islands which I visited but found nothing different from the main land; in fact they were too near and too small to have a flora of their own.

It was my intention to proceed as far as Nemoro, but the Japanese objected, because they said that the frost would interfere with our investigations and I was reluctantly compelled to return to Sapporo by the same road.

I left Akkeshi on the 8th of September, taking with me from the different stations on the road, the plants which I had collected.

At Chitose I met again with Lilium medeoloides, and as it is scarce in other places I procured a large supply of it.

I reached Sapporo with all the plants I had collected on the 28th of September, and after making an additional collection of trees and seeds in that neighbourhood, to be forwarded to Tokio, I started for Ishcari.

This road leads through a fertile and well-wooded country. On the road well cultivated farms are seen and the wood is composed of a great variety of beautiful timber trees. It is difficult to say which tree is the most abundant, but near Shinoro the chestnut and the walnut are decidedly the most prominent. In the woods around Ishcari maples are more abundant; they are generally large trees, but I noticed one of smaller growth, with leaves colored dark blood-red, which had a magnificent effect. All the trees already mentioned such as Magno-

lia, Tilia, Aralia, Quercus, &c., seem to flourish and do well here.

The "*Kokuwa*," a fruit which had been described to me as a great delicacy, I here had an opportunity of tasting for the first time. It has a peculiarity of not being eatable before it has had a certain amount of frost. Its flavor is delicate and resembles the taste of a fig combined with that of the grape. If taken in large quantities it acts as an astringent medicine. A number of fruits were gathered and preserved in sugar, which, I believe, have been sent to Tokio.

On the 5th of October I returned viâ Sapporo, Tomakomai and Horobetsu to Tokarumui, and collected on the road all the living plants which I had observed before, but which at that season could not be removed.

At Tokarumui I was especially fortunate in securing a great variety of trees and shrubs. Among other shrubs I found a Lindera, always employed in Japan for making toothpicks, which are a household necessity in this country. Clerodendron trichotomum grows here to an enormous size, sometimes attaining a diameter of one foot and a height of thirty feet. *Sansho* (Zanthoxylon) also grows to good-sized trees of about the same dimensions. I am convinced that this place is very rich in its vegetation and it would well repay a closer investigation another season.

I returned to Tokio on the 26th of October, leaving the plants in charge of the Japanese officers who accompanied me. The plants have now reached Tokio. The living ones are planted in the gardens at Aoyama, and the dried collection is undergoing classification.

I have to acknowledge very gratefully the kind assistance of Mr. Carl Kramer in the classification of the dried plants, and in the preparation of the report, as well as in lending the most valuable books required for the work.

During my journey I have had various occasions to observe the zeal displayed by Mr. Ota in assisting me and have much pleasure in expressing here my best thanks.

I must also commend Mr. Yasui, my interpreter, for his great diligence and his exertions in smoothing over difficulties which sometimes occurred.

Trusting that I shall have an opportunity of completing my researches in the island of Hokkaido next season,

I have the honor to be,

Sir,

Your most obedient servant,

LOUIS BÖHMER.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT

OF A

GEOLOGICAL TRIP THROUGH AND AROUND YESSO,

WITH NOTICES OF THE

TOPOGRAPHY, TIMBER, POPULATION, AINOS

AND OF THE

PROGRESS OF THE GEOLOGICAL SURVEY;

BY

BENJAMIN SMITH LYMAN,

Chief Geologist and Mining-Engineer to the Kaitakushi.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

NOTE.

This report was originally a daily record of the manner in which the time had been spent, and contained much additional matter that was intended particularly for the consideration of the Government rather than for the general public. To save the labor of a thorough recasting the form of a journal has been retained and the dates given at which for the most part the writing was done.

FROM YEDO BY HAKODATE AND SAPPORO TO KAMOIKOTAN.

YEDO, 19th November, 1874.

GENERAL HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

SIR,

I give you below for transmission to the Kaitakushi a detailed report of my field work of the past season from the time of leaving Yedo until reaching Kamoikotan, where the long report sent you from Nemoro begins. The present paper is almost wholly made up of extracts from my letters to you of the dates given, and only slight verbal changes have been made in them.

On the 18th of May last, we left Yedo and went on board the steamer *New York*, at Yokohama; on the 19th at daybreak, we sailed for Hakodate; arrived there late in the evening of the next day; and landed on the 21st, and began preparations for the journey to Sapporo, and I gave written instructions to my assistants. The 23rd of May, I accompanied you on a visit to the Government

farms at Nanai $10\frac{1}{2}$ miles ($4\frac{1}{4}$ *ri*) distant, and returned to Hakodate the same day. The 24th was Sunday, but one party of my assistants started for Sapporo; on the 25th further preparations for departure were made; and on the 26th I set out in your company for Sapporo, and we reached Mori, $28\frac{3}{4}$ miles ($11\frac{1}{2}$ *ri*), the same day.

The 27th of May, we crossed Volcano Bay to Tokarumui, or Shin (New) Mororan, in a diminutive steamer that had hard work in rather rough water to finish the passage of about 25 miles (10 ri) in seven hours and a-half. The 28th, we viewed the site of the new saw-mill across a small arm of the harbour, and made some soundings in different parts of the Bay near by. In the afternoon we rode out a ri or more on the new road to look at some places proposed for new settlements. The 29th was spent in an excursion to the farming settlement at Mombets on the shore of the Bay near Usu. We went across in the little steamer; afterwards rode from Mombets and old Mororan, and re-crossed in the steamer again. We had to stay at Tokarumui the 30th, on account of heavy rain; and the 31st, Sunday, because news came that the Horobets having no bridge was too high to cross otherwise. On the 1st of June, however, after a walk in the morning to the top of the neighbouring mountain where a trigonometrical signal had just been put up, news came that the road was passable, and we rode the same day to Horobets, $12\frac{1}{2}$ miles (5 *ri*).

On the 2nd of June, we rode by Shiraoi to Tomakomai 31 miles ($12\frac{1}{2}$ ri); passing on the way the Tarumai Volcano to our left. A man at a tea-house on the road opposite the Volcano told us that the late eruption began at noon on the 8th of February last, and continued until noon the next day; but that it was most active from five in the afternoon until two o'clock in the morning. The woods and bushes were set on fire to a distance about

half way from the crater to the tea-house. The material thrown out was pumice of a light brown colour in pebbles about the size of a filbert; and it covers the ground, partly burying the grass, and rests on the roofs of houses along the road to a depth of about three-tenths of a foot, but is confined to a short space only. The smoke rising from the volcano when we passed was much more conspicuous than it was last year, and about ten times greater in quantity, the man said. Nobody had yet gone up to the crater since the eruption.

On the 3rd of June, we left the sea shore, which we had so far followed with its narrow plain of pumice and with its mountains to our left; and rode inland still on the New Road by Stose (Chitose) as far as Shimamap about twenty seven miles and half (11 ri.) Near the hotel there was the first rock exposure, a layer of compacter pumice than usual, or perhaps trachyte, some ten feet thick, in small cliffs and in a cutting on the road. On the morning of the 4th, we rode on to Sapporo, thirteen miles and three-quarters ($5\frac{1}{2}$ ri), over a rather broken country most of the way, as indeed it had been since leaving Chitose.

On the 5th of June, we visited the Governor of Sapporo in the fine new capitol building; and on the 6th went with him towards Zenibako to look at some lands intended for settlers. A rain storm on the 7th, kept us in the house all day; but some of the preparations for the field work were continued. On the 8th, we again rode out with the Governor of Sapporo to visit places that had been selected for new farm settlers. On the 9th, wet weather, prevented my assistants from setting out (by boat) for the Ishcari coal fields, but they came and received lengthy instructions. The high water of the river kept them from starting on the 10th also; but on the 11th, in spite of doubtful weather which really turned out rainy,

they went in canoes down the Toyohira. The 12th, 13th, 14th, 15th and 16th. were still either rainy or so threatening that by your advice I did not set out myself, although at length all the preparations had been finished.

On the morning of the 17th, however, the weather seemed finally to have cleared off, and my assistant Mr Akiyama and my interpreter and I started in boats on the Toyohira about a ri from Sapporo. We had two large row boats and eleven canoes manned by Japanese coolies and by Ainos, and loaded with our baggage and large supplies of rice and other food, enough for our trip up the Ishcari and some of its branches and across the mountains until we should meet some boats sent up the Tokachi river with food for us, a journey that it was reckoned might last seventy-five days. We had with us, besides the crews, two servants and two Japanese coolies. The river where we started was said to be about half a foot higher than common.

Camp on the Ikusubets, 22nd June, 1874.—After leaving you we went quickly down the Toyohira to its mouth on the Ishcari at Tsuishcari, in about three hours; and found the river there a dozen feet higher than usual. Mr. Akiyama sounded frequently on the way down and the least depth was five or six feet, generally there was as much as ten feet at least. Near the mouth of the river the flat land at the sides was in some places very widely overflowed. Most of the way the timber looked very unpromising, scarcely anything but small (or rather small) willows and those in many places very thin. Some of the empty houses that we saw last year at Tsuishcari have been torn down, and the two or three remaining ones are occupied, and all the cleared land seems to be coming into cultivation and is fenced in. Some men were busily at work grubbing and digging, a much better sight than the desolation that was to be noticed there last year. There

appeared, however, to be no spare house room for passing travellers, and the weather too was not so unpromising (although cloudy) as to justify staying there. So after leaving behind one of the big boats as too slow compared with the canoes (to one of which I betook myself) we went on as far as to the mouth of the Ebets, the river that heads up on one side near Chitose, and the one which we were to explore a little towards its other head-waters on the North towards Yubari mountain. We camped near the mouth, having some difficulty in finding dry ground.

The next morning (18th June) the interpreter and I went on up the Ebets with seven canoes and three Ainos in each, besides my two servants and the two Japanese coolies and ten days' provisions. We paddled along most of the way among the trees that bordered the river, for the banks were overflowed. At noon we reached the Yubaribets branch, and went up it several miles that afternoon passing through a wide lake-like expanse of water. The next day (19th June) we went on some miles further in the morning, finding the river now within banks, and having here and there pebbly beaches which contained pebbles of coal. The afternoon was very rainy and we staid in camp.

It cleared off the next morning (20th June) and we started (after an early lunch) before noon and went on to a point just beyond two large branches, one on either side at a distance of about thirty miles from the mouth of the Ebets. As we found coal pebbles at that point and therefore proof that coal outcropped on the waters of the main branch above the mouth of the side branches of any size, we went no further. We had also seen rocks exactly like those that accompany the coal of the Horumui field. It was therefore certain that the coal field reached to the upper valley of the Yubaribets, and that it would be worth while to extend the survey from the Horumui so far at

least in that direction. I am curious to learn whether the topographical surveys now in progress on the streams further to the southwest which empty into the sea beyond Yubuts do not also show the presence of coal by such coal pebbles. It seems very likely that the coal reaches as far as Mombets (near Uragawa) without interruption; and in that case it forms a very important coal field. It would be very fortunate if it should turn out that there is some feasible place for an artificial harbor beyond Yubuts, as it would very much help the shipment of the coal.

The timber that we saw on the way did not on the whole seem very valuable, especially on the lower waters, where it was chiefly willow. On the upper waters was some good timber. On the other hand there was a great deal of open prairie land, particularly one very long prairie on the left bank of the Ebets, which must contain some five thousand acres or more. If a road should be built straight from Sapporo to the coal we surveyed up here last July, it would pass right through that prairie. Near the mouth of the Yubaribets there is on that stream a great deal of low wet land.

The next day, 21st June (yesterday), we came back rapidly with the current to the mouth of the Ebets where we had left Mr. Akiyama with the rest of the boats and men and baggage. On the evening of our first arrival there, some additional Ainos from Ishcari that had been engaged joined us. Night before last, before dark, the Ainos played an interesting game; two parties some twenty yards apart threw back and forth a ring some six inches in diameter which the opposite party tried to catch upon long poles (like lances), probably the ones they had been poling the canoes with. It was a very picturesque sight to see them rushing forward eagerly with spears high in air trying to catch the ring.

This morning (22nd June), we all came up the Ishcari to the mouth of the Horumui; but the interpreter and I, as before, left Mr. Akiyama and some of the men and boats there, and came on up the Horumui with half a dozen canoes and for greater speed four Ainos in each. About noon we reached the mouth of this branch of the Horumui (the Ikusubets, as they insist it should be called, though according to the Map of Matsura it should be the main stream). As we were coming up, towards camping time, we were suddenly met by the canoes from above which carry this to you, on their way back from our surveying party at Poronai.

Camp at the mouth of the Horumui; 30th June.—We camped once more on the Ikusubets on the 23rd of June, and reached the coal region at Poronai the following morning (24th), and camped alongside of the young gentlemen who are surveying there. The rest of that and the next day (25th) were spent in receiving information from them about their work, in giving them various instructions and in testing their compasses. We were kept there two days more (26th and 27th) by rain, and one by Sunday (28th), and came away yesterday morning (29th). The delay gave me a chance to make a little map from my sketches (last year and this) of the Toyohira, Ebets, Yubaribets, Horumui and Ikusubets. According to this map (which differs very much from the printed maps), it is eleven ri by the river from here to the mouth of Poronai, probably about five ri across from the coal north-westerly to the Ishcari river, and also about five ri north-easterly from the coal to the Sorachi coal region. The young men are to run a line to the Ishcari and another to the Sorachi coal region, determining as well as they can the limits of the coal all the way. While at Poronai I improved the opportunity for giving all the young men some lessons and practice in the measurement

of logs, standing trees and forests, in hopes that some of them at least would be so much interested as to make such measurements now and then during their season's surveying, and so be enabled to give us at least a rough idea of the amount of wood, fuel and timber in different spots.

Sorachibuto; 8th July.—My letter of the 30th of June had hardly gone when the weather improved, and we set out at once up the Ishcari; and that afternoon reached the narrow neck of only seventy feet in width where the Ishcari winds around for a couple of miles at the mouth of the Bibai river. We camped on the neck (called Bibaidap), and the empty boats were all hauled across within ten minutes, except one boat, which being in advance and manned by strangers did not notice the neck and went all the way round and was astonished to find our tents already pitched on the shore far in advance of them when they came in sight. With the hand level we found the difference of level of the water on the two sides of the neck to be 1.9 ft. The bank is already cut down by the floods to within about two feet of the level of the water on the upper side.

The next noon (1st July) we reached the Shibets, a small river or large brook on our left going up. We spent some time in searching for bits of coal, and found them not only at the mouth where the Ishcari might have dropped them, but full half a mile up stream far out of reach of the Ishcari. So it is pretty certain that the mountains to the northwest contain coal on this side, probably a continuation of what is already known on the other side (on the west coast); so that the coal there also probably covers a large space. We went that afternoon to Tomushi, a small brook, and camped on the beach.

The next day (2nd July) brought us some distance above Naye brook, and on the way we passed an Ainu

village of some five houses at Urashinai, and picked up some Ainos of the Middle River region. Their salutations with some of our former men at the first resting place we came to were very elaborate and grave and silent; and were not even followed by any talk at first, and evidently there was no desire to learn the latest news on either side. That afternoon we passed Kabato river on our left, but it was so insignificantly small that I did not recognize it nor know of it until we had gone far beyond next day.

The next day (3rd July) we arrived here at the mouth of the Sorachi before noon, and after leaving some of our luggage, boats and men we went right on up the Sorachi. We picked up an Aino guide, a fine looking man, at a village of two or three houses a mile or so above the mouth of the river; but it turned out next day that Tetta, one of our Ishcari Ainos, had been five days journey up the Sorachi to a (fifty foot?) high water fall to catch fish, and knew as much about the coal as the guide did.

We had to camp at the Borato brook, a mile below the nearest coal, and the next morning (4th July) went on five miles or so to the principal exposures at Kebushinai. All the exposures are in the cliffs along the banks of the Sorachi. We stopped and measured the beds of coal and some of the rocks as we went along. They said there was no coal further up, but that evening I found some large lumps of it on the beach a quarter of a mile above, and the next morning (5th July) we went beyond and found still a very fine set of exposures of all the coal beds. Owing to the windings of the river and the changes of dip of the coal beds, these are exposed each two or three times. The beds (to tell the best of the story first) are very fine as to thickness and some of them as to quality. The thickest coal bed has the enormous thickness of nineteen feet at one place, but not the best quality; at another

place a thickness of thirteen and a-half feet of coal; another coal bed has eight feet and seven-tenths of thickness and the best quality at two places; another, six feet and six-tenths and the best quality; besides that, there is a bed of four feet and a-half, one of four feet and one of three feet and a-half, making six workable beds, and a thickness in them, all together, of about thirty-six feet. The thickness, however, varies very much at different points. As for quality the appearances are good; but we have taken samples for assaying from the different workable beds; as Mr. Enomoto's last year was probably selected of the very best quality, not as an average, and he did not know certainly from which bed it came.

The hills, however, to begin the darker side of the story, are so very low just about the best exposures as to give a very small quantity of coal above water level. There are, however, hills of some height to the north-east close by and the coal doubtless runs into them, and perhaps can be opened in them quite as near to the Ishcari as these Sorachi exposures. But the great difficulty is in regard to shipment. The Sorachi, though two hundred feet wide at the mouth is a very shallow stream, say about the size and depth of the Toyohira at Sapporo, and, and like that, very rapid, with numerous ripples where even the canoe touched bottom, although since that the river here has gone down a foot and a-half. The banks are low in many places, say four or five feet high for long distances, so that even damming without long levees would not give much depth of water. The distance by river to the nearest coal (and though that is poor, the others could probably be opened near by) is about three ri and a-half ($8\frac{3}{4}$ miles), and the distance straight is about two ri (5 miles); or to Kebushinai two ri and a half ($6\frac{3}{4}$ miles). As the coal must of course be sent by a tram road to the Ishcari, the advantage of near-

ness as compared with the Poronai (Horumui) coal is almost lost; for when the coal is once on a car it does not matter so much whether it has to go two ri or five. As to the depth of the Ishcari too, Mr. Akiyama (who sounded as we came along) reports a depth in the channel of only seven feet at several places this side of Urashinai, and since that the Ishcari here has gone down at least a foot and a half. So that it will not be possible to bring up very large vessels so high. Besides the distance is of some importance, for although the swift current would take the loaded vessels down very well, yet it would certainly be a little troublesome to bring even empty ones back again. The distance to Sorachibuto (buto means mouth) from Horumuibuto is about twenty ri or fifty miles.

But the nearest point probably for shipping the Poronai coal would be at the mouth of the Bibai, some five ri or twelve miles and a-half above Horumuibuto; and up to the Bibai neck Mr. Akiyama found everywhere at least twelve feet of water. I have hopes that they will find the coal reaching from Poronai some distance in that direction, so as to shorten the distance (about five ri and a-half) by a couple of ri; and there is a rumor to the effect that some such coal has been found already by a man that is now with the party in Poronai. That seems to me (at present) decidedly the best region for opening coal in the Ishcari valley. Its greater nearness to Sapporo and civilization would make the opening of mines there easier at the outset and cheaper to oversee and keep supplied with food. A road of only eleven ri or twenty-seven miles and a-half would reach from Saporo to the coal mines. A railroad of less than fifty miles would reach from the mines to Otarunai passing near Sapporo. But perhaps a still more convenient point for mining coal will be found near Rurumoppe (north of Ishcari) on the west coast, for there is coal known in a neighbouring valley,

and it seems quite probable that there is a large field of it in those mountains.

We reached Kebushinai on the 4th of July, and staid there over the next day, Sunday, and came back here on Monday, (6th July), after taking the samples. Yesterday, (7th July), and to-day, I have been finishing sketch-maps, sections and instructions for the guidance of Mr. Yamauchi and his party when they arrive in this region The big boat having carried its load some distance above this, returns now.

Kamoikotan (or Cliffs of the Ishcari); 11th July.—On the 8th, after finishing my letter to you, we set out again on our way up the Ishcari, although it was about two o'clock. We reached in less than a mile the Tuppu river which is put down on the maps as somewhat higher up. We went a quarter of a mile up stream on it, and searched carefully for bits of coal among the beach pebbles, and at length found a large number of very small ones; showing that there is probably coal up the river though a good ways from the mouth. The river comes to the Ishcari from the West, and at the mouth is some fifty feet wide and perhaps three feet deep.

A quarter of a mile above its mouth we passed, on the easterly bank of the Ishcari, a village of five Aino houses, some of whose inhabitants were on the bank looking at us; but considering the rareness of foreigners in these parts there seems to be less curiosity about them than you would expect. Our own Ainos however show a good deal of curiosity when I take my daily swim in the river, and they are probably surprised to find that I am more hairy than many of themselves, though a good deal whiter. I am satisfied that on the whole the Ainos are no more hairy than Caucasians; for I know old school mates or others that are still more hairy than I am, though perhaps not so much so as the hairiest of our Ainos; and there are

longer beards in America than any of our Ainos' beards. One of our young Aino men, or rather a boy, though about full grown and doing a man's work very ambitiously, has no beard at all, and several of the others have very little to show of that kind. Even the bushy heads of hair would not be noticeable at home if well cut and combed; a friend of mine there used to have just such a head of hair. Two or three of our Ainos, however, are very hairy; one in particular has shaggy epaulets of hair on his shoulders, besides much on his breast, shoulder-blades, arms and legs; but he seems to be quite an exception.

Less than a mile and a-half above the Aino village we came to the Shushun river on the westerly shore; but although given on the printed map as a large long stream, it is really but half a dozen feet wide and a foot or so deep. We spent some time there in pushing through a thicket for half a mile or so to find some pebbly beach; but the river flowed everywhere through merely mud, and the search was given up. We went but half a mile further up the Ishcari before we camped for the night; having come in all about two miles and a-half (a little over a ri).

The next morning (9th July), we reached the Oshirara river from the West or north-west, and found it some thirty feet wide and perhaps six feet deep. We searched carefully through a bed of pebbles without finding any traces of coal, and so gave it up. In the afternoon we reached the Uriu river on the northerly shore of the Ishcari: and very quickly found on a pebble beach abundance of coal bits even up to the size of a turkey's egg. The river is about a hundred feet wide and three feet deep. It leads towards Rurumoppe, and its coal is probably part of the same field with that of Rurumoppe. The size of the lumps seemed to show that the original bed was not so very far distant. About a mile above that we passed the Aino village called Memu, one of three houses,

That day we went about six ri and a half by my reckoning.

The next day (10th July, yesterday), we had no tributary rivers of importance to search for coal bits; though we reached here and had from time to time to stop to look at rocks of geological interest; for we are now in the midst of the mountains and on the last part of the way passed numerous rock exposures. We saw enough to convince me almost that the two groups of rocks I called in my report of last Christmas the Toshibets Karafto and the Horumui Karafto are one and the same; although there are some singular geological facts connected with the group. If so, the rocks that I took last year to be underneath the Horumui coal are newer and perhaps cover it in places. Those rocks were almost the only ones we saw yesterday, but on arriving here towards night we found different and older rocks which I have not yet examined closely. Among them, however, is at least a little lime-stone, but I have searched all the way up the Ishcari and on the side streams in vain for any pebbles of lime-stone. On the Sorachi to be sure was a little lime-stone near the coal, in balls, and it seemed so heavy as to be fit for iron ore. It was, however, too little in quantity to be worked except one four inch seam close under a good coal bed, which could therefore be taken out easily enough. Iron ore indeed is what now seems most lacking for the future manufacturing prosperity of Yesso, and it is hard to believe that so large an island should not have it abundantly in some place.

As for coal, any body not familiar with such calculations would be astonished to find to what large numbers of tons it counts up. Take, for example, the border of the field from the place of last summer's survey (Poronai) to the Sorachi region, and call it in all, say twenty miles (eight leagues, or ri) long; and call the average thickness of the workable beds, altogether thirty feet, or ten yards;

and the average height to which the beds extend above water level, one hundred and five feet, with an extent therefore along the slope (of say 45 degrees) of fifty yards. Then for every running yard there would be 500 cubic yards, or say tons, of coal above water level, and in a running mile 880,000 tons, and in the twenty miles 17,600,000 tons; and if, as is probable, there be everywhere as at Poronai and at Sorachi two rock saddles at least, so that the coal may be found on both sides of each, making four outcrops of each bed, there would be some 70,000,000 tons of coal above water level. If this border of the coal field be, as may very well turn out, but one side of a field that is also quite as wide, then the whole of the boundary would probably have three or four times as much coal above water level besides what fills up the interior of the field. But so far only the coal above water level has been mentioned; the coal below water level would be as much more for every hundred feet of depth, or in a depth of four thousand feet (the limit of workableness, as is supposed), there would be forty times as much more. And yet, although we have already got up among the thousands of millions of tons, we have been estimating the probable contents of but one field and that not so very large, while the bits of coal in the rivers seem to show that there is another field perhaps as large on the West Coast near Rurumoppe, if not much larger reaching northward. If the Kaitakushi should go to work with might and main at coal mining with the help of a railroad up the East side of the Ishcari to the Sorachi with branch roads to the mountains, or with railroads to other points, there is already no danger that it could exhaust its coal resources in centuries. In saying so I take the Horumui (Poronai) coal to be continuous with that of the Sorachi, as is almost certain from the great resemblance of the section of the rocks at the two places, in spite of the

thickening of the coal beds on the Sorachi, and as is not at all improbable from the nearness in a straight line, only some fifteen miles (six ri). The mining need only be limited by the demand for coal; and if good iron ore can be found, the manufacture of iron would consume an indefinite quantity of coal.

Here at Kamoikotan, the rapids and narrow pass which divide the Middle Ishcari from the Upper Waters, there is after all no water fall, only boiling rapids for a ri or less in length. We are camped on a small bit of flat prairie land, a quarter of a mile above the lower end of the rapids. Yesterday, we passed a good deal of open prairie land and latterly a good deal of light timber: but lower down the river the timber is generally pretty heavy, though not commonly extremely close. Some of our canoes, the best, are towed up the rapids to the Upper Waters, and the rest are sent home again. It is said now that it is not possible to cross from the head waters of the main stream to the Tokachi, but that you can cross from the head of the Chubets to the Tokachi; so it is still undecided which pass we shall try, or whether we shall not go first up the main stream to the water-fall said to be two thousand feet high (where the impossibility of crossing on account of the steepness begins) and then come back and go across by the Chubets.

I have the honor to be,

Sir,

Your most obedient Servant,

BENJ. SMITH LYMAN.

FROM KAMOIKOTAN ACROSS THE MOUNTAINS TO OHOTSUNAI.

NEMORO, YESSO, 26th August, 1874.

GENERAL HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

MY DEAR SIR,

You have taken such a lively interest in my work that you may not find amiss a more detailed account, day by day, of the journey across from the Ishcari to the Tokachi; although the edge of your appetite for it has perhaps been taken away by the somewhat lengthy letter that I scribbled off the other day at Ohotsunai.

12th July, 1874. Sunday.—In the afternoon we moved the camp from a quarter of a mile above the lower end of the Kamoikotan rapids to Harushinai, a small brook at the upper end of the rapids, a distance of a mile (15 chô) and about due east. The tents and baggage were carried by the Ainos on their backs; their own luggage and the rice had already been carried, and the best of the canoes had been towed there against the current. There is no waterfall at Kamoikotan, only very strong rapids with

many rocks in the stream. The interpreter's levelling with the hand level made the fall from beginning to end of the rapids 54½ feet; the distance as already shown is about a mile and a-quarter or half a ri. The distance is rather roughly estimated from the number of my steps, which were, however, irregular in length and crooked in direction.

The path is nowhere difficult, and the hills nowhere press so closely upon the stream as to make the building of a road or even of a railroad very difficult. About half way between the two camps some huge (10 ? foot) blocks of dark greenish or brownish almost black serpentine are seen and from being highly polished by the water are much admired by the Ainos, who rub the smooth surface and put their eyes close to it to see the reflection. From the size of the blocks the bed they come from must be at least five feet thick, probably it is much more. The other rocks along the shore are metamorphic talcose and quartzose schists and dark quartzite with a strike of about north and south; and probably belong to the Toshibets Karafto group of rocks. The lime-stone at the lower end of Kamoikotan rapids has already been mentioned. It is a blue marble with white streaks, in appearance a good deal like the Pennsylvania marble, much used in Philadelphia for door steps and other building purposes. The thickness of the bed is at least, seven feet and perhaps much more. The marble and the serpentine will both yield valuable handsome materials for ornamental uses, for chimney pieces, table tops, floors, door steps, pillars, and the outer walls of buildings. The supply will probably be quite large enough for the demands of Yesso, and may even be sent to Nippon, if there be no nearer and more convenient quarries of like material. Neither the limestone nor the serpentine was found again above Kamoikotan, unless possibly some of the polished

blocks in the river a short distance above the rapids were serpentine; all those tried proved to be quartzite. But many small bits of serpentine were found among the pebbles of the Harushinai brook, close above the camp; though none of limestone nor of coal were there.

This morning, before we started a mystery was solved that had puzzled me for some days. The Ainos had now and then produced with some kind of pipe very melodious flute-like notes, that seemed by their sweetness to show great musical taste, though there was seldom even an approach to a time. It turned out that the hollow stem of a tall weed, four or five feet long, was blown through at the small end, and the variation in the notes was produced simply by the natural breaking up of the vibrating column of air into halves, quarters, thirds and the like.

13th July.—We set out this morning with eleven dug out canoes and five Ainos to most of them, four to the rest; forty-eight Ainos in all. A few Ainos and all the Japanese boatmen had been sent back from Kamoikotan. We had still with us, besides the Japanese cooly interpreter for the Ainos, two Japanese coolies, my cook, my boy, Mr. Akiyama (assistant geologist, quarter-master, entomological collector and sounder of rivers) and the interpreter (acting also as assistant geologist and botanical collector); making with myself fifty six men in all.

The current was at first still very strong with many large rocks in the stream, and the strength of the Ainos was well strained. A couple of miles above the Harushinai camp we came however to a place where the river was for a short distance free from such rocks and straight with a uniform current, and we stopped to measure it roughly. We found the width to be about 300 feet; the depth at three points about 75 feet apart from one another and from the shore to be 2.7 feet, 5.8 feet and 2.3 feet; and the greatest surface current velocity to be five feet a

second. The discharge then is about 3,240 cubic feet a second; or as one or two small brooks had been passed above Kamoikotan, the discharge at Kamoikotan is in round numbers about 3,250 cubic feet a second. This with the fall of 54½ feet would give a little over sixteen thousand horse power (allowing 20 per cent for loss of power by the machines) enough to run the mills of a large town. A dam of fifty-five or sixty feet in height at the lower end of Kamoikotan would be short, because the hills there come near to the river on either side; it would perhaps be hardly two hundred yards long at the top (the river itself is perhaps a hundred feet wide). From three-quarters of a mile to a mile (10 to 15 chô) at most below the place for a dam there is a flat plain, mostly an open prairie on either side of the river which would give building room for a large town. It seems perhaps wild to speculate on the building of mills here with nothing at present to manufacture; but the day will certainly come when this magnificent water power will be used for working up material brought a less distance than the raw stuff is carried that chiefly occupies the mills of the Merrimac. Meanwhile these 16,000 horses are running loose day after day, and as many more night after night, with nothing whatever to do.

A little before noon, we reached in about four miles (1½ ri) from camp the Etambets, a considerable stream on our left which I roughly estimated to have a discharge of seventy cubic feet a second. We went up it some three hundred yards and searched carefully among the pebbles, but found no trace of coal nor lime-stone nor volcanic rock, and very little serpentine. The pebbles were almost wholly (or quite so) of highly metamorphic rocks.

The Ishcari flowed still between hills, but not very high ones (say 250? feet high); near Kamoikotan they were perhaps 500 feet high. The hills on our left continued

(but growing lower and lower) as far as the Osarappe a small brook a mile or so (half a ri) above the Etambets; but on the right the hill ended at least half a mile lower down stream. In flowing among these hills the river has exposed the solid rock in a few places; and it is always a dark grayish highly metamorphic sandrock or quartzite with a strike of about north and south and a dip of forty-five or fifty degrees westerly.

Above the Osarappe the current becomes a little less violent, and we soon came to a fish-weir, the first we had seen since leaving the Toyohira, and the first sign of the Aino settlements of the upper Ishcari. About a mile (15 chô) above the Osarappe we came to the Chubets on our right, a river a hundred feet or so in width with a discharge of perhaps 550 cubic feet a second. A short distance up it is the "Obanya," which figures so largely on Matsura's map that you would suppose it at least to be a very important trading post. It had been agreed that we should stop near here, even if we arrived early, in order to give our Upper Ishcari Ainos a chance to visit their homes or neighbours. But before camping we went on a mile and a-half further up the Ishcari, passing an Ainо house on the way, and stopped at a good clean wide beach of sand and pebbles opposite another Aino house; having accomplished according to my sketching $7\frac{3}{4}$ miles (3.1 ri) in the day.

We had come into a beautiful level region with prairies and light woods, and with distant mountains in almost all directions and with Ishcaridake towering up before us to the east, with many large snow patches on its top. It was impossible to help exclaiming that this was the Cashmere of Japan. I insisted that if the Mikado should come to Sapporo next year he should by all means be brought to the upper Ishcari; for the trip would be a very easy one and he would not only be delighted with

the scenery and with the wildness of the region, but would enjoy the novelty of a little camp life, which could easily be made as comfortable and luxurious as could be wished. The greatest Mogul Indian Emperors travelled much with a camp, and sometimes most luxuriously. A river steamer drawing less than five feet could go all the way from Ishcaributo to within fifteen miles (6 ri) of Kamoikotan, and by deepening one place of three feet deep, some one hundred yards long, it could go to within a mile or so of Kamoikotan. The distance is about 110 miles from Ishcaributo and could easily be run in ten or eleven hours. From the landing place a wagon road of seven or eight miles could be made without trouble into the heart of the little paradise of the Upper Ishcari. His Imperial Highness could therefore sleep on the comfortable river steamer at Ishcari (or on the sea steamer), could start at dawn or a little later, arrive at Kamoikotan by 4 o'clock in the afternoon, and be taken in a comfortable coach by 5 o'clock to a camp either near where we camped or on some of the hills nearer to Kamoikotan. One of the hills was said by the interpreter to resemble a famous mountain in his country, where there was once a great city. The steamer, if allowed to, might make daily trips and bring up any number of followers of the Court as well as supplies of food. If the Emperor were so inclined he could indulge in a little hunting; and he could even set apart the whole of this little valley for his hunting park. But I trust that its plain will rather be covered with grain to be ground at the mills of Kamoikotan and with flax to be made there into linen. If the Emperor should come once, he would surely wish to come often; as those Great Mogul Emperors used to go to Cashmere, a far lengthier journey; and he would perhaps like them build a fine summer palace and baths, and he could ornament them with the marble and serpentine of Kamoikotan.

As we had reached our camp ground by half past two, Mr Akiyama and the interpreter and I, wishing to see the famous Obanya and finding there was no path across by land, took one canoe and a few Ainos and went down again to the Chubets, and up it half a mile, then up a small high water channel on our right for half a mile more. There in the tall grass we found a solitary frame building about fifteen feet square, closed and deserted; and this was the Obanya! Close by were the fallen ruins of a house that had been there, but at present there is no habitation near. The Obanya is (as it turned out) a sort of store-house built about twenty years ago by a tradesman of Ishcaributo for use in connection with the salmon fishery. By peeking through the cracks we saw the building was nearly empty, but perhaps with some nets and the like lying on the floor. So here was dispelled our vision of a great mercantile establishment.

The pebbles of the Chubets seemed to be wholly of metamorphic or volcanic rocks without any bits of coal or of lime-stone or of serpentine. And the beach at the camp had only the same kinds of pebbles.

14th July.—This day we went, by my sketching, 19¼ miles (7.7 ri), more than we used to make in a day on the Lower and Middle Ishcari; probably because, as the river has grown narrower, less time was lost in crossing the river from side to side at the bends, to avoid the swiftest current, and poles were used instead of the oars more constantly than before. The measurement of my sketching is very rough, yet to a certain extent consistent with itself. The sketching is aided by a sort of triangulation; on the covers of the note-book lines are drawn from the corners at an angle of 45 degrees with the sides, so that when the edge of the book is held parallel to the river or to the boat, sights can be taken square across the river and forward (or backward) at an angle of 45 degrees

with that, and if the boat, as usually happens, is close to one bank, of course, the sights cut off on the opposite shore a space equal to the width of the river. Knowing roughly the width of the river, one such space and angle after another is plotted roughly by the eye and with the help of a pocket compass (best, one hung on gimbals) in the lap or on the bottom of the boat. I do not yet know how accurate the sketching may turn out as compared with an instrumental survey; but at the mouth of the Tokachi my sketch of about 265 miles (106 ri) from Sapporo differed in latitude but seven miles and a-half (3 ri), about three per cent, from that given on Matsura's large map. About one-third of the sketch too was of the journey on foot and probably less exact or uniform than the boating part. The difference in longitude was greater, but corresponded well to the error we found in Matsura's map at the dividing range; and somewhat with the error of thirty miles (12 ri) in longitude that is said to exist in the maps a little further east at Nemoro.

The river at starting this day was in one channel about 240 feet wide, but afterwards was much broken up into small side channels forming islands. Such channels the Ainos call Makumbets; high water channels or old ones they call Fushikobets. The current as we went on grew stronger and the violent rapids more and more frequent.

The country continued flat and here and there were a few open prairies, but generally the land, at least near the river, was covered with light woods. Indeed, we found above Kamoikotan no heavy timber to speak of until the very day we crossed the mountain to the Tokachi or the day before. Perhaps however, the woods further back from the river and on the mountains may generally be heavier than what we saw. It is probable that the soil of this Upper Ishcari region is not very rich as it apparently comes chiefly from very siliceous materials. Yet

on the flat plain the soil must in part come from volcanic rocks and may therefore be rich.

We found the size of the branch streams sometimes to vary from what it would appear to be from Matsura's map. The Purebets for example on our left was some twenty feet wide with a roughly estimated discharge of sixty-five cubic feet a second; the Ushishipe on our right was perhaps fifteen feet wide with a discharge of say forty cubic feet a second; and there were some other much smaller streams.

15th July.—We started about seven, our regular hour, and reached the mouth of the Aibets, four miles and a half (1.8 ri) by my sketch, a few minutes after ten. As I had been quite overcome by the heat or the fatigue (or both combined) of the day before, and had with difficulty struggled along in the morning, and as it had been raining for two hours, I was happy to believe that it had set in to rain all day, and had the camp pitched. By noon, however, it had cleared up; but my illness was willing again to use the excuse that our geological assistants regularly have Wednesday afternoon as a half holiday; so we stayed there over night.

The Aibets is some twenty-five feet wide, with a comparatively gentle current and with a discharge of perhaps fifty cubic feet a second. Its pebbles are in great part of volcanic rocks; the rest are metamorphic or crystalline; a few are of a gray syenite; fewer than has been usual in the streams below are of black or blackish fine grained quartzite.

From the mouth of the Aibets to Sorachibuto and indeed you may say from Tsuishcari (near Sapporo) the general course of the Ishcari is south-westerly, but above the Aibets its general course is northwesterly, about at right angles.

The mouth of the Aibets was Mr. Wasson's furthest last

year. In his first trip it was of course useless to search further for a convenient place for a geodetic base line; and in the second trip the approach of winter prevented his surveying beyond.

Above this we met with no Aino houses nor signs of their presence; and below we had seen but three or four of their houses since leaving Kamoikotan. Yet the Aino population of the Upper Ishcari is reckoned at 200.

Our Ainos said that no one had ever crossed by the Aibets valley to the northeast coast; but so far as we could see and judge by the map it would be easy to do so.

16th July.—In spite of all ailments we started and worried along, and they in great part disappeared in the course of the day; but instead of trying to see how much heat could be endured I tried to see how much needless exposure could be avoided, and sat bareheaded in the shade of an umbrella, a thing that had been made use of while travelling by boat and sketching in raining weather.

In a mile and a half we came to low hills close to the river, and the rest of the day commonly had them so on one side or the other of the river, but not at the same time on both. Near the river they rose to a hundred feet or 150 feet or so in height, further back to 300 feet or so. We had passed through the plain of the upper Ishcari in 28 miles (11 ri) by the river, or 18 miles ($7\frac{1}{4}$ ri) straight, and this may be taken as about the diameter of the plain. Two rocks in place were noticed, but there were some big blocks of metamorphic sand rock. The river was narrower than the day before, and still much broken up into side channels (Makumbets); and the rapids were still more frequent and difficult.

At length we camped towards the end of the afternoon after accomplishing but $8\frac{1}{4}$ miles (3.3 ri) the rapids were so strongly against us.

17th July.—This day we had hills close by us nearly

all the time, especially on the left, commonly 200 to 500 feet high. On the right were very few hills near the river. On the river banks were now and then exposures of rock in place; some of them a gray crystalline volcanic rock (trachyte ?) apparently level; some were dark greenish or blackish metamorphic sand rocks or quartzites, with strike north and south and dip 20 to 45 degrees easterly, and further on 20 degrees westerly.

About noon we reached the Antarama brook on our right with a width of some 30 feet and a discharge of perhaps 30 feet a second. Shortly after that we came to (50 ? foot) high cliffs of light-gray volcanic rock in the hills near on our left, the first of many such cliffs that we saw almost daily until we reached the Tokachi valley. Ishcaridake is with little doubt an old volcano, and very likely Tokachidake too, and perhaps others of the neighbouring mountains. At any rate they seem to be surrounded by thick layers (at least 200 feet in some cases) of light gray or buff volcanic rocks still level bedded or very nearly so; and the two mountains have also the appearance of old volcanoes from their form. The underlying metamorphic quartzites seem to be less frequently exposed the nearer those mountains are approached.

The river grows more and more rapid and difficult and is still somewhat broken up into small channels by Makumbets. We made therefore but seven miles and three quarters (3.1 ri) by the sketch.

18th July.—We had gone, but a mile and a-quarter ($\frac{1}{2}$ ri) this day through a flat country with light woods when we reached the Rubeshibe, a stream on our left, some fifty feet wide with a discharge of perhaps 125 feet a second. The Rubeshibe was Captain Bridgeford's farthest last year; and above this only one of our Ainos had ever been. He had gone to the falls of the Ishcari

with Mr. Takabatake in 1872; but seemed to have a very imperfect recollection of the route and distances. By Matsura's map (of 1860), who had also gone to the "falls," we thought it could be hardly a day's journey more to this wonder of the world. So we struggled along against the rapids which grew worse and worse, and threaded our way through the Makumbets (which however, were becoming rather less numerous); and by working until half past six went in the day eight miles and a quarter (3.3 ri) or seven miles from the Rubeshibe.

The hills were rather less frequent than the day before and of about the same height. In the afternoon we had a near but hazy view of Tokachidake, very high before us. The nearer hills were perhaps five hundred feet high, chiefly seen on our left. There were a number of exposures of dark or blackish quartzites (one of them shaly and full of specks of iron pyrites) in place, with dips of 20 degrees to 15 degrees westerly, and one near the end of the day of 50 degrees easterly.

This afternoon we met with a Rhododendron in bloom, just like our American plant, the deer-tongue laurel, except perhaps shorter leaves. There were, however, no thickets of it, only single plants. We were here probably some 1,500 feet above the sea, and nearly a degree of latitude north of Sapporo, and fully two north of Hakodate; yet this plant seemed to thrive and abound although it is rare in America north of Pennsylvania. We found it often afterwards until we had gone far into the Tokachi valley. The woods through the day were as usual light, and there were no prairies.

Sunday, 19th July.—Soon after starting in the morning we had our first view of Ishcaridake since we had left the neighborhood of the Chubets; and soon saw Tokachidake again.

We pushed on in spite of the worse and worse rapids,

and of the dispiriting information from our Aino guide that we could not reach the falls to-day. But as he had said the night before last that it was only half-a-day's journey distant, we put no great faith in him. Indeed I began to suspect that there were no falls at all as we had gone far past the place for them according to Matsura's map. The falls are not given there but two hot springs are given, and they were said to be close to the falls. We struggled on against the almost constant rapids for two miles and three quarters (1.1 ri) until noon. We had passed high cliffs of light-gray volcanic rock on our left near the river and just before noon one of a hundred feet or so in height close to the river on our right.

We stopped to lunch at a pebbly beach near the mouth of a small stream on our right, which by Matsura's map should be the Hombeushi. During luncheon time the Ainos declared that it was impossible to take the loaded boats further, and the guide said that Mr. Takabatake left the canoe loads here and went on a little further with a light canoe and then on foot to the falls, still at a great distance, too far to reach to-day. This information was brought to me where at a modest distance I was drying my outer and under clothes in the hot sun; for just before landing we had shipped a heavy sea in a boisterous rapid, and although I was sitting by way of precaution on a rubber blanket that covered my small satchels with the spyglass, barometers and other hand instruments, and though I was covered with a rubber coat, the mass of water came in and filled the blanket to a depth of two or three inches in which I had to sit some time. The day before, one of the other boats carrying rice had been flooded. Such are the accidents of navigation here; but we were comparatively fortunate, for some of our predecessors had had boats upset, it was said.

The choice was given to our Ainos to go ahead at once on foot or in the boats; and after a lengthy powwow they chose to go on foot. The boats were unloaded at a better place a couple of hundred yards down stream on the other side, and were drawn ashore into the bushes; and preparations for the march were begun. But some of the luggage was to be taken back from here in the boats to Sapporo; my outer tent, for example, and several other things; and it was necessary to dry them thoroughly first and then pack them in birch bark to keep them dry. So we concluded to pitch our camp for the night. Afterwards as we had had no day of rest I decided to stay over Monday, and everything could be well dried, and some of the Ainos could go on to spy out the land towards the falls and make, or at least blaze, a road.

20th July.—A party of Ainos with the coolie interpreter started off early in the morning and came back about sunset. They reported that they had gone to the hot-springs and to the so-called waterfall close by them, about four ri distant from camp, they thought; also that there was after all no genuine water-fall, cataract, but something stronger than a mere rapid, probably a cascade; but it was their opinion that we could not get beyond. Visions then arose of a narrow canyon with immensely high vertical walls of these volcanic rocks, a country in fact like that of the Colorado river. Projects for circumventing the obstacle floated through the mind, such as going up side valleys to the tops of the cliffs, marching along the dividing ridges as long as thirst would permit and other plans; but it began for the first time to seem really possible that we might have to turn back after all our efforts and take the Chubets route as the Ainos had advised. It was said we had fifteen days' food with us, eighteen bags of rice; though I could find but sixteen the next morning, the rest were

said to be at the Aino camp a hundred yards off. We had expected to carry twenty-five days' food on leaving the boats, but found we had load enough for the men; for in the first estimate something had, it seemed, been forgotten, probably the Ainos' own baggage, what with deerskins, smoked fish and other things quite a respectable item. Other supplies of rice had been left behind they said at the Aino house opposite our first camp above the Chubets, some two or three days distant. We could go, then, but six days forward without having to turn back in case of not succeeding. Such thoughts we had to dream on.

The day had in great part been spent by me in writing to my instrument-maker a detailed account of a radically new surveying instrument that had been running in my head for some days and had finally come into definite shape; and that will perhaps now be manufactured in time for my Kaitakushi work of next summer. Towards night my outer tent, well dried in the sun, was carefully packed, together with the iron tent-pins, my thick quilt used in place of a mattress and a small under-pillow; likewise a box of mineral specimens and some other things that it was not necessary to carry on the back over the mountains. The bamboo tent-poles, too, were heavy, and on trial it was found that poles cut day by day in the woods could be used very well without tearing the tents.

21st July.—After a little delay every Aino had his load, and that a heavy one, on his back and off we started by the path that had been blazed the day before. And comparatively easy walking it was too, sometimes through open woods without much bamboo, sometimes along the pebbly shore of the river. I had hung the open leather case of my field glass on my breast and placed in it a small compass hung on gimbals, so that I had merely to lower my eye in order to see our

compass course and was therefore able to conjecture from time to time what the general course had been. The compass, however, was not quite satisfactory, because I had had to replace the original needle and compass card that were out of order by a small pocket compass set loosely into the cup that hung on gimbals. In addition I counted my steps (with a pebble transferred from one pocket to another for every hundred steps and another pebble to another pocket for every thousand steps, eighteen small pebbles in all; my pedometer had been left behind because it had proved untrustworthy) without, however, trying to make the steps of any special length nor to walk in a straight line; to have done so would have caused far too great delay. I estimated the average length of the steps on rough ground when reduced to a straight line to be commonly two feet; and so with the estimated general course from point to point have contrived to make a very rough map to bridge the gap between the slightly better mapped boat journeys.

About once in two thousand steps the Ainos would stop to rest, and it seemed to a greenhorn astonishing that they could carry such loads even so far as that. For my part with my satchel and compass and everlasting counting and the rough road the resting places seemed quite far enough apart without any load on my back; even though I regularly walk five to eight or even ten miles daily at Yedo without feeling the least fatigue. No less was I rejoiced when the hour of noon arrived and we stopped to eat our lunch by the riverside. Not long after lunch the hot springs were reached, about half past two, and the falls just beyond. In spite of all our incredible exertions and fatigue the distance still lacked a thousand steps of two ri, was in fact $4\frac{2}{3}$ miles (1.85 ri); so much for all our pains.

Soon after starting we had a good sight again of the

top of Ishcaridake, the last we should have for some time, the near hills and woods so hide it. We passed some cliffs of volcanic rocks a hundred (?) feet high on the opposite, southerly bank of the river; but still no sign of the thoroughly impracticable region of canyons.

Leaving the hot springs to be revisited from the camp, although the Ainos stopped at them with great interest, we hastened on to look at the far famed falls and to have the camp pitched among the rocks close by them. We found the last account of the falls pretty correct though it had been rather vague. The water rushes rapidly down a steep channel much encumbered with rocks, and is more violent than a mere rapid though there is nowhere a cataract, hardly even a cascade. The interpreter at my request levelled from the bottom, a short distance above the hot springs (although there is a long less violent rapid below that), to the top and found the whole fall to be 47½ feet in a distance of about 260 yards (130 ken), in which space the river sweeps round in a curve of nearly half a circle with the hot springs in the hollow of the curve, on the northern side of the river. This, then, was the upshot of the statement on a map said to be by Mr. Takabatake that the falls were 2000 feet high, and of the story told last year after his visit that they were one ri in height!

On our side of the river was a high precipice to the water's edge, which had given the impression of its not being possible to go further. But almost a glance was enough to see three ways by which we could advance: 1st, we could either climb over the wall of the precipice, not extremely difficult; or, 2nd, we could go a little below the hot spring and ford and then go up the other side of the river without precipice or obstacle; or, 3rd, we could make a bridge of logs across from one large rock or group of rocks in the river to another and so from shore to shore.

This last plan pleased Mr. Akiyama also, and when the camp had been pitched he collected a large number of Ainos and set about the work. On our side was a great deal of drift-wood, some pieces large logs. He had a small stick of timber put across at the water's surface to the nearest rock and immediately crossed on it himself to the rock. I went to see the springs and on coming back found he had got logs laid across from rock to rock as far as to the last one short of the other side by a wide gap of about thirty-five feet. He soon, however, had a long slender stick laid across here, but it sank to the surface of the river or just below, and the volume of water here was great and the current tremendous. He told some of the Ainos to cross in the stream by holding to this log; they hesitated a moment; he with a cry of impatience began to strip off his own few remaining clothes; and then for shame an Aino crossed, and after that another. After that Mr. Akiyama followed himself, but it seemed as if he must be carried down stream. Then one or two more Ainos followed. They sent for an axe and the saw, which were taken across the last gap by a rope. They hunted about in a grove there and found a stick long enough and not too heavy for them to manage, and after much trouble got it to the shore and let one end float round from up stream until it was caught by the Ainos on the rock and laid in place. But it was so slender it sagged into the water as the other had done. By Mr. Akiyama's order, however, plenty of Ainos now crossed on the two sticks and after a time they got down two stouter logs one after another and laid them across side by side above water level. Then they crossed from the shore to the rock, Mr. Akiyama as usual the first, and put supporting sticks for the middle of the logs to stop the vibrations a little; and the bridge was done before night. Indeed Mr. Akiyama quite distinguished himself by his activity,

intrepidity, judgment and control of the men; and, as I said in a former letter, deserved promotion in the field at once if that had been in my power.

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The hot springs proved to be very feeble ones about 25 yards apart and some 200 yards below the falls. The temperature was in one 47 degrees Centigrade, in the other 45 degrees C. The water seems to be impregnated with iron, as the ground it flows over has become covered with iron rust. Some ten yards above them is a still smaller cold spring that leaves a very small deposit apparently of sulphur. The springs on the whole are among the least important I have seen in Yesso, and hardly deserve each the two big characters given them on Matsura's map.

The high cliff at the falls was not of volcanic rock but of metamorphosed quartzite without any clear dip. On the first rock of the bridge the 'Ainos found many small specks of iron pyrites, in color like gold, and probably such may be found on shore; for a beautiful specimen of pyrites was shown me last summer that was said to come from here, and Mr. Takabatake, I believe, brought back a story that there was a gold mine here, and left a jocular inscription somewhat to that effect.

The travelling time taken in coming to the falls from Sapporo, subtracting the time spent in excursions up the branch rivers, was thirteen days; to the head of canoe navigation twelve days; to the Rubeshibe eleven days; to the Aibets nine days; of course, returning down stream would be quicker. You see, then, how incorrect was the official statement made to me last year at Sapporo that it would take three months to make the trip up the Ishcari and return; three weeks would have been more exact.

22nd July.—It is proverbial in America that nothing

is easier than falling off a log, and I was so fully impressed with that fact in consideration of the wet slippery character of some of the logs of the bridge and of the smallness of some, especially the first ones, four or five inches in diameter, and close to the tearing water or in it, in consideration, too, of an easily turned head and inexperience, that I was not content with going barefoot, but must needs have a rope stretched across as a hand-rail from rock to rock and held by strong Ainos at either end (one of whom owing to a misunderstanding offered at first to carry me across on his back!) With such ignominious aid the crossing was easy enough; but the others, even the cook, scorned like assistance, and the Ainos walked or ran back and forth as if on a smooth, broad floor, perfectly at home.

Less than a quarter of a mile above the falls in a favorable place I made a rough measurement of the river, and found it about 90 feet wide with a depth at most of six feet and a surface velocity at most of four feet and a half in a second; giving a discharge of about 972 cubic feet a second, or adding two small brooks we had passed above the falls one on either side, in round numbers 1,000 cubic feet of discharge in a second at the falls. That would give with the fall of 47½ feet about 4,300 horse-power, allowing 20 per cent. for imperfection of machinery. A dam would scarcely be needed; for the water might be taken from the top of the fall and carried by canals to the sufficiently flat and wide land close below on either side of the river.

Meanwhile most of the Ainos had forded the river, and in attempting to follow, my boots filled with water at the top, and some who had not crossed signalled to climb over a hillside on our right. We had hardly done so, with a little trouble, when Mr. Akiyama pointed out some hot springs he had found there, a quarter of a mile above

the falls, at the river's edge, and some others more difficult to reach a few yards lower down stream. Though not very large springs they were much more so than those below the falls. About a hundred yards further up stream we found two or three more such springs somewhat larger. We had no thermometer with us, but by the hand the temperature was estimated at 80 degrees C., much hotter at any rate than the springs below the falls. There seemed to be little or no mineral matter in the water, no deposit of iron rust, sulphur, silica or lime. I have named the two groups of springs above the falls Akiyama Hot Springs; Upper and Lower, for Mr. Y. Akiyama. For there is no tradition even that any one had ever passed above the falls, and we were therefore the discoverers of new land and entitled to give names to our discoveries. Though the field for discovery was not very large it was doubtless much the largest in Hokkaido, for the Ainos go almost everywhere and give names to all the streams and places. Indeed there are not many large regions of the world where names could be given by explorers, if the native names were respected, instead of every nation's saddling its own set of names on a country, as has happened around Japan. The same fact of novelty added zest to our work, and we felt as we rounded every corner that we looked on a scene that had never for a hundred years at least been before the eyes of man. Who knew but we should discover a little paradise up here like the one above Kamoikotan?

Some seventy yards above the upper Hot Spring we passed on our right a brook with a discharge of twenty cubic feet a second or more, and with its stones all reddened with iron; and I have named this Akiyamagawa, also for Mr. Y. Akiyama. About a mile and a-half above the falls we passed another brook on the right with a discharge of twenty feet or more a second, and with two

mouths. I named this stream for the interpreter of our party.

The hills were close to the river on either side, but we managed commonly to get along near the river's edge without much climbing or wading. Still it was very rough walking indeed, and in spite of all efforts to go at least eight thousand steps (3 miles) before lunch, I sank down exhausted on an inviting rock sixty-five steps short of the goal, and most of the rest had already stopped to eat, although it was not quite twelve. After lunch and a nap and all the Ainos had passed, I followed in their beaten track, and had hardly gone a hundred steps when I found all were fording in a very difficult place, as our road was cut off by a cliff some 200 feet high of volcanic rock. The water was so deep that it was necessary to strip off foreign clothes, and the current so swift that several of us had to hold the hand of an Aino in crossing, and two Ainos were assigned to me. Some of the servants and coolies in ambitiously trying to cross without help were nearly swept away before help reached them.

We had dressed, and had walked on less than a mile when another cliff of volcanic rock some sixty feet high prevented our going further without crossing; and a like cliff on the other side, though it left space to clamber along, partly wading, for a quarter of a mile, compelled you to cross again before the upper end of the gorge was reached, some five hundred yards in all. So here I had to strip again, and though the current was less violent had to be led across by an Aino; then to go up to the upper crossing, cross again with help in a swift current, and then clamber and wade along the foot of the cliff to the upper end. For such work Japanese straw sandals were given me to bind on the foot, and they were a great protection against injury from the stones and against

slipping. To stem the current also we all used a long staff cut in the woods. Although the place was so troublesome it is a fine one to see, and will no doubt be much visited when the valley shall be opened up by a road very easy to make; it is in fact the most striking feature of the valley that we discovered. I have therefore taken the liberty to give your name to it and to call it Capron Canyon. The walls are quite vertical, and rudely columnar; the river makes a bend in passing through the canyon, so that you cannot see from one end of it to the other. Some seventy yards above the gorge a stream of fifty cubic feet or so of discharge in a second came in on our left (north-east), probably the largest branch stream we met with; and I have named that also for you Capron River.

With all this troublesome fording we got on slowly; besides we had at times to pick our way along a rocky, cliffy shore, half in the water, half out, finding with difficulty foothold; and for my part my long boots several times filled with water from the top so that I had to pull them off, empty them and wring out my clothes. Sometimes to avoid fording some of us would climb a steep hillside. With all these delays and difficulties it was five o'clock, theoretically our regular camping time, when we reached a little flat ground on the southwest side of the river, and pitched our camp, for my part quite exhausted, although it was but five miles (2 ri) that we had come in the whole day. The river was so broad and shallow at the camp that a tall Aino carried me across on his back.

In the afternoon we had a small thunder-shower, the only rain we had through the whole foot journey. The woods all day were light, and the valley very narrow; even at the camp the flat was hardly twenty yards wide. The cliffs of volcanic rock had grown lower and lower

and opposite the camp was one but about twenty feet high.

Here and there through the day we still met with exposures of the dark or blackish quartzites that underlie the volcanic rocks; and one such exposure was at the upper end of Capron Canyon.

23rd July.—Henceforth the big Aino, having in the evening fished for information and found that there was a prospect of special remuneration, was very zealous in helping me on his back across the river, which had now become more practicable; and I consequently could go dry shod.

We had gone about a ri this morning when we passed (they told me afterwards) the mouth of a stream on our right which had a course nearly parallel but opposite to that of the main river; and the Ainos call such a stream, that forms as it were the barb of a hook with the main river, Horika, and our Ainos for example called this Horikaishcari. As there is such a name on Matsura's map, probably taken from the older map he copied of about a hundred years ago, it is likely that the valley had been somewhat explored above the falls before that time, at least by Ainos. Our Upper Ishcari Ainos, who had last winter crossed in the snow by the Chubets to the Tokachi River, wished to turn off and go up the Horikaishcari, insisting that our proper road led that way. The idea was absurd according to what information we then had, and still seems so; but it is possible that my Japanese companions would not have had firmness enough to resist the advice; at any rate one of them thought it worth while to mention the matter as it might possibly affect our plans. It is interesting, however, as showing how little dependence after all can be placed on the so called "sense of direction" of the Ainos.

Three-quarters of a mile further on, we came to a stream on our right with a discharge of twenty cubic

feet or more a second; and I have named it Araigawa in honor of Mr. I. Arai of the Kaitakushi. The Ishcari Ainos here again wished to turn off and go up this stream as was mentioned to me at the time by the other of my Japanese assistants.

The walking was much easier to-day, commonly over level ground with sand or small pebbles instead of the big blocks of the day before. The fording was far easier, but very frequent and in one case quite deep, so that to go dry it was necessary to sit on the Aino's shoulders. We camped well tired at the end of $6\frac{1}{4}$ miles ($2\frac{1}{2}$ ri.)

The cliffs were less frequent and lower, but once a hundred feet or so high, gray volcanic rock; there were a few exposures of the dark quartzites; the valley was rather wider with a few level flats of a quarter of a mile or so in width; and the woods were everywhere light except a few good-sized firs. But still we did not find the little paradise. The sky was cloudy all day and the mosquitoes terrible; a thorough dog-day. Our course through the morning was south as for some days past; but afterwards southwest, about at right angles. We had two or three sights at Tokachidake and Ishcaridake in the course of the day.

24th July.—Another dog-day with terrible mosquitoes until 2 o'clock, when a change in the wind brought great relief.

We had gone a mile and a-half when we found a stream on our right with a discharge of thirty cubic feet or more in a second. I have called it Otorigawa in honor of General K. S. Otori, of the Kaitakushi. Our Ainos started off up this stream, as if possessed with an evil spirit, and had gone a couple of hundred yards before they could be recalled and made to return on the other side through thick brush. It turned out that they supposed it our best road to the Tokachi.

At the end of about three miles (1.7 ri) from camp we came to another stream on our right with a discharge of twenty-five cubic feet or more in a second; and I have named it Yamauchigawa, in honor of Mr. R. Yamauchi, of the Kaitakushi.

At six miles (2.4 ri), we passed on our right again a stream of forty cubic feet or more of discharge in a second; and I have called it Nishimuragawa, in honor of Mr. Nishimura, of the Kaitakushi. The Ainos here again wished to turn off to the right, westward.

The walking to-day was still easier, the fording easier too, as the river was smaller and smaller, and at length even my boots defied it; so that by 4 o'clock, we had gone six miles and a half (2.6 ri). We were delighted to find the river here divided into two nearly equal forks, and as the one on our left seemed to lead most directly to the Tokachi, before starting up it, we pitched our camp for the night at the forks. On measuring the two forks roughly and estimating the velocity, our left hand (eastern) one proved to have a discharge of about $39\frac{1}{2}$ cubic feet a second, the other (western) $52\frac{1}{2}$ cubic feet and therefore this was the main stream. As these figures are more than I had guessed it is probable that the other estimates of the streams newly named were too low. The smaller one of the two I called Kaitakugawa, in honor of the Kaitakushi, and in hopes at the time that it would be "opened up" by a road to the Tokachi valley.

A good deal of heavy fir timber was passed in the day, but the rest was light. We met with strawberries just ripening, as we had also the day before. They had flavor enough but were very sour. We saw too the Rhododendron in bloom this day and the day before, as well as for some days past. We were at the forks some 3000 feet above the sea, and in the course of the day had risen (by aneroid) some 750 feet, and the day before some

500 feet. I read at reaching and leaving every camp three aneroids and my two assistants each one ; but the readings of all have not yet been compared. Near the mouth of Yamauchigawa I took a vertical angle to the top of Tokachidake (as I supposed) with my prismatic-level-pocket-sextant and found the height to be about 8200 feet above the sea ; but that is very rough.

We saw this day (as we had also seen just above the Falls of the Ishcari) tracks like those of a dog, but much larger said to be those of the Oinu (Great Dog) or Yamainu (Mountain Dog), a wolf, said to be a huge beast twice as tall as the wolf of Nippon and to attack even a horse. Tracks of bears were pretty frequent ; deer tracks still more so, but much less so than on the lower Ishcari waters. Two of the Ishcari Ainos were so foot-sore that it was arranged they should stay behind here with ten days rice for them.

25th July.—The valley of the Kaitakugawa seemed very level and open while the valley of the main Ishcari seemed to be much shut in with mountains. So we set out in the early morning very hopeful of finding a low pass. The stream was now so small and soon so much smaller that my ferryman's special occupation was quickly gone.

We had hardly walked a thousand steps when we came on our left to a brook of perhaps fifteen cubic feet of discharge in a second, which left our main stream so much smaller than before that we had renewed hopes of reaching the source the same day.

For the first ri the road was rather easy and flat, with 50 foot, 100 foot and 300 foot hills near by on either side, and with heavy fir timber all about us. About the end of the ri we came to exposures of the blackish quartzites again (with dip of 30 degrees westerly), and they were hereafter frequent ; and no more volcanic rocks were

seen until we had descended into the Tokachi valley; we had got above the level of the volcanic beds. About here we found a patch of snow some five yards in diameter and a foot thick; some 4200 above the sea. After a little rest and refreshment at the snow bank we pushed on, now eastward instead of south-eastward, up the valley which had become so narrow that we had commonly to walk in the brook, and this had begun to be rather rapid in its fall. A thousand steps beyond the first ri brought us to a waterfall of twenty feet in height which there was a little trouble in climbing round by the steep rocky hillside. The dip of the rock had become sixty degrees, but was still westerly, and it continued westerly till we had crossed the mountain.

At less than eight thousand steps we stopped to lunch, about four thousand and five hundred feet above the sea; and the road was getting a little difficult, though with easy bits here and there. Though the valley was so narrow it still seemed rather open before us, as if there were a low pass. The trees had dwindled to mere brush, chiefly birch. We had come upon strange flowers of quite a northern and American look, and even the Ainos were interested in the change and stuck some of the flowers upon their load, besides calling the botanical collector's attention to them. The most striking new flower perhaps was a magnificent buttercup with flowers two inches and a half (0.2 feet) broad; and the common small buttercup grew alongside. The interpreter had his tin box crammed to overflowing with botanical specimens before we reached the top of the mountain. Indeed his collections of these high mountain plants, the first ever made in Yesso, will undoubtedly be of the greatest scientific interest and will be quoted throughout the botanical world.

At nine thousand steps the stream forked and we went up to the left, although the other fork was nearly as large.

The stream now became rapidly smaller and smaller, losing here and there a side rill; and our path grew steeper and the trees lower and lower, until hardly anything but a dwarf five-leaved pine was left, and that only a foot or two high, but very widely spreading. The absence of trees however gave us the better view, but the valley was too narrow to see much downwards, though we had views of Ishcaridake (as we took it to be). At length some of us had passed the little spring that was the source of the brook, and were climbing by the steep mountain side hoping soon to have a view at least of the pass, when there came a great calling and shouting and talking on the part of the Ainos below and around us. Then a shout from them for Mr. Akiyama to bring some medicine as an accident had happened; but he had eagerly gone on still further in advance. At length the Ainos answered me in Japanese that one of the Ainos below had met with an accident, apparently a serious one, probably an arm broken. The interpreter who had been close behind me had already started downward; and I turned back too with great regret at having to descend so far when so near the summit, but with the belief that even my very limited surgical knowledge and experience was far superior to that of the others. On reaching the wounded man it turned out that a loosened stone, large and sharp, had fallen from above and cut a bad gash perhaps an inch and a half in length, in the corner of his forehead close to the temple. My interpreter and the coolie interpreter were with him and one or two Ainos near, the rest had gone on. Some green leaves had been put on the wound, and paper tied over it; and the man seem either in great pain or almost faint or frightened or interested in receiving so much attention. I happened to have some court-plaister in my pocket, and to have had the experience on the lower St. Lawrence of putting plaister on a similar wound in the forehead (from the swinging

of the boom of a sail) under instructions from the experienced sufferer. So I cut the plaister in narrow strips and laid them cross-wise of the gash. It was arranged that the patient should come on with frequent rests, and that somebody else should carry his load. As we had been eating more than a bagful of rice (a man's load) a day we were less heavily loaded than at first. On getting nearly back to the point I had reached before, I met Mr. Akiyama coming down with a brilliant scarf in his hand, which through the rest of the trip the wounded Aino wore around his head apparently with pride. A single inch of difference in the course of the stone towards the temple would undoubtedly have ended the man's life.

Up and up we went, steeper and steeper, following still for a time the dry bed of the narrow rivulet. Then we turned off to the right a couple of hundred yards and soon after three o'clock about four miles (1,6 ri) from the camp of the morning reached the lowest point in the summit of the mountain, the Kaitakutoge (or pass), about six thousand feet above the sea. Here we had a view of the valley to the east, and it seemed to correspond well enough in appearance with what we had expected from the map. A small stream lay before us running a little south of east though a nearly flat country; at some distance, before reaching a north and south mountain range it seemed to join a larger stream running southerly and afterwards perhaps turning south-easterly as we expected from the map. Near the turn, behind a mountain, we expected to find the Aino village Kuttarushi, where boats and food should be waiting for us. All but the flat valley before us was a confused mass of mountains, especially southwards, many of them sharp peaks. The distance was hazy and we could not see the sea as we had hoped to do. Every where were green woods; two or three white cliffs in the distance could be seen

near the river; but nowhere any smoke or trace of an Aino habitation.

Looking westward we had a view of the snow patched top of Ishcaridake and also of Chubetsdake (perhaps), and took a rough vertical angle with my pocket sextant to get the height as we had done lower down. The result is a height of about 7700 feet above the sea for Ishcaridake, and that is perhaps correct within a couple of hundred feet; but the distance, on which the calculation of the height above the barometer reading depends, is very uncertain. Ishcaridake is much broader and larger than Tokachidake and has a much greater amount of snow, but seems by our measurements to be some five hundred feet lower.

Near at hand on the west the mountain side looked very bare, for even the pine had dwindled to hardly half a foot in height and was found only in patches. At a distance of half a mile to the southwest the keen eyes of the Ainos spied a large bear walking leisurely about, but he was far from seeking our society when he perceived us. On the east the mountain was extremely precipitous, and close before us was a narrow very steep gully filled with a patch of snow a dozen feet wide from the top to some one hundred yards down, where the gully turned and the end of the snow was hidden.

The Ishcari Ainos were asked rather triumphantly if they did not now recognize the Tokachi valley; on the contrary they pointed to the southwest and said the mountains there were those near the Tokachi valley! It required confidence in maps and geography to withstand such persistence as theirs.

When all had arrived at the mountain top, even the wounded Aino with his brilliant bandage, the question was how to get down on the side. Some of the Ainos were for clambering down the steep, rocky, cliffy side of

the mountain ; but I advocated going down by the snow ; a plan which did not meet with much favor. Still to show its feasibility I started down that way myself, poor mountaineer as I am, and with the help of my umbrella and a blunt, light level rod they handed down to me and of my boot heels I descended gradually without sliding at once to the bottom. Getting on one edge of the snow it was a little easier going, half on the rock or earth, half on the snow. When I had got something like half-way down the visible part of the snow, they shouted from above that a better path had been found, and that as it led in a different direction it would be hard for us to meet below this night, if I did not join them. So, much worn already with fatigue, I had to climb back again, but was helped by my strong Aino who let down a rope to me and pulled me up from place to place. Then we went some three hundred yards southward along the mountain ridge, rising a hundred feet, and after refreshing ourselves at another snow bank began to descend about five o'clock. For some 700 feet down, the mountain side was all open, and, though very steep, not at all impracticable. We zigzagged along down sometimes clinging to the grass or to a small bush. Near the bottom of this space one of the willow boxes fell and rolled down a long distance, but was recovered much broken. The Aino had probably had to part with it in order to save himself from rolling down too. At the bottom of the 700 feet was a small rather flat spot where we rested, although it was getting so late and the foot of the mountain was so distant. Just there we came to a grove of small (yellow ?) birches. To our right, southward, was seen a large valley, which proved to be probably a branch of the one we were descending, and which seemed to lead to a lower pass near the head of the main Ishcari, but we could not see far enough in that direction to decide this point. However if there be a lower pass

there, we probably had not had food enough to go that way, as it would have been at least a day or two longer.

In the grove, we wound round a nose of the mountain and descended pretty rapidly. Within fifty feet of level we came to small bamboo about two feet high to which we could cling. At length some of our Ainos told us as we passed that some of the others had found water just beyond, and we pressed on eagerly for it; but it proved a falsehood, and we were pointed to a place a little further on. The interpreter and an Aino got some distance in advance, and after a long silence answered the shouts of the others, but said the way they had come was bad. So the Ainos with us went further along towards the ridge of the nose, and one group after another tried going down more directly; and so we got scattered. Mr. Akiyama was far behind urging on the rearward Ainos, who were as usual the Ishcari Ainos, decidedly inferior to the Chitose and Shiraoi Ainos with us. After going down a little we came to precipices fifteen or twenty feet high, which the interpreter somehow had managed to descend; but which we, especially the loaded Ainos, must go round. I found at length a small ravine that led past the precipices, and gave welcome drinking water too, and one after another four or five Ainos and my servants joined the interpreter and me at the mouth of my little ravine, on a small brook. The cook was said to have fallen down a precipice "four ken" (24 feet) high; but he had no broken bones. We walked down the steep brook a couple of hundred yards and came to a waterfall a dozen feet in height. The Ainos explored a little and found a way to get down to the brook below, by using care and clinging to the weeds. It was then about 8 o'clock and beginning to grow dark; so, almost exhausted with fatigue, I was glad to consent in view of the difficulty of following down so precipitous a valley in the dark to

bivouac here, perhaps about five miles (2 ri) from the morning's camp. Not only my servants but my food and blankets were with us, and one tent. The ravine was too narrow to pitch the tent, but the four Japanese including the interpreter, slept together under the tent as a coverlet; while a separate bed was given me and the Ainos even undertook to spread some oil paper we had on a framework of sticks over my head. Of course we slept in our clothes and for my part very comfortably, except that my wet feet were rather cold even in my boots. As for food, hunger is the best sauce, and the cook, under specially unfavorable circumstances, seemed therefore to succeed better than usual.

26th July, Sunday.—Of course we had not been unmindful of our companions, and wondered where they might be; but going in search of them had been impossible. Early in the morning an Aino came up our brook to us (in answer to a shout from our Ainos); and it turned out that he and two others had bivouacked without food some 300 yards lower down; and that there were two or three waterfalls in that distance. After breakfast we followed his guidance, and kept on further down. We came to a high waterfall and had to make a long difficult détour to the left, and, just before we had got to the brook again, the willow box of the Aino who was leading us rolled down the steep hill. He bounded after it as if he were on a level plain. At the end of a quarter of a mile we found Mr. Akiyama and some Ainos on a small, nearly level spot where they had just arrived. He had kept the men moving until ten o'clock at night, but contrary to his judgment they had taken a bad course; at length they had to bivouac on the steep mountain side without water and no food but poor rice. Yet even with them the excellent sauce of hunger made the food taste

good. Other Ainos who had been with him through the night were now coming in, and we stopped for some two hours while food was cooked and eaten.

Thereafter the way was much easier and at the end of another quarter of a mile we came on our right to a much larger brook of perhaps 30 cubic feet of discharge in a second, probably from the valley we had seen to the south the evening before. Here also was the beginning of a large plain or nearly level ground; we were fairly down from the mountain. Following down the rapidly growing brook, still in an easterly direction, we found it at the end of half a mile or so to have a discharge of perhaps 90 cubic feet a second and to be joined there by a stream from the north-west of perhaps 60 cubic feet of discharge in a second. It was noon by the time all without exception had arrived here, and on account of their great fatigue the Ainos begged to rest until the next day. So the camp was pitched after a journey of about a mile (15 cho).

We had now come down to a level of about 3000 feet above the sea, about the level of the mouth of Yamauchigawa. The woods were everywhere pretty thick and of pretty large size, chiefly fir, but a good deal of smaller hardwood.

In descending in the morning we had seen several exposures of dark quartzites with a dip of 60 or 70 degrees easterly, the opposite direction to the dips of yesterday, showing that the mountain ridge is formed by a rock saddle or anticlinal.

27th July.—We were well rested in the morning and and started off promptly, with loads much lightened by the six day's rice that had been eaten. In fact the Ainos raced along at a most astonishing rate compared with what they had done on the Ishcari. Instead of stopping every third of a ri or less to rest they would go a whole

ri at a time. The valley was flat near the river, but a short distance back were bluffs of some 20 feet in height at first, afterwards fifty feet or so, above which it was flat again. The country was all wooded and with small bamboo under the trees. We could often therefore go for a long distance on land without fording, sometimes by a deer path (for traces of deer were much more common here than on the Ishcari above the Falls). Now and then, however, we had to ford, and later in the day still oftener on account of cliffs along the shore; and at such times my Aino ferryman was a great help. He would also sometimes lead me over the flat topped hills to avoid fording. Coming down such a hill in the afternoon to cross a brook we saw a small tree that had been cut with an Aino knife, and soon after found the remains of an old Aino camp; the first signs of human existence we had met for many days. At length after racing along in this way through the day we encamped on the left bank of the river at the end of ten miles (4 ri), a day's journey that seemed marvellous in comparison with what we had hitherto done.

Our general course had been southeast, more easterly at first, afterwards more southerly. The stream had gradually become quite a large one with a discharge of perhaps three hundred cubic feet in a second. In spite of their heavy loads, on dropping them to rest the Ainos are always active to strip off from an ohiyo tree the bark from which their cloth is manufactured, and which they used raw on the journey for making sandals, or rather shoes covering the toes and heel better than the straw sandals; or to hunt for large fishes in favorable portions of the streams. Some throw big stones, if necessary, into the water to make the fishes move about; others are on the look out, often up to their middle in the water, and spear or hook them in the side with a hook of some three inches

in diameter that is tied on the end of a long pole so as to have the sharp point forward. Many trials are made for one success. Of course, in striking, allowance has to be made for the refraction of the water, which makes the fish seem higher than the point at which the hook is aimed. All along the cold clear waters of the Upper Ishcari such attempts were extremely frequent, and large fish (masu), a foot and a half long, were added to the delicacies of the Ainos' repasts. On the Lower Ishcari and its waters venison was a more frequent addition than it was further up, indeed almost a daily one. This day about noon, the Ainos hooked a large fish (a kind of masu) which they said in the Ishcari did not go far from the sea; so that they were already encouraged by the fact. The Ainos also caught many small fish with hook and line, and the servants and coolies early in the journey caught the fever of doing the same. After pitching the camp this evening two or three Ainos in front of my tent caught small fishes almost as fast as the line could be cast. They had also caught many at the last camp. These small fishes seemed to be trout of two kinds; one was called the little masu, but is not the young of the masu they say. One kind was speckled with red dots. Both kinds are about half a foot long or a little more.

We passed in the day many white or light gray or buff cliffs a hundred feet, sometimes even 200 feet high, of soft, rough volcanic rock, level bedded or nearly so, without any trace of columnar structure; in the early part of the day it was a tufa with pebbles of the size of a pea or a little larger.

The timber was generally pretty heavy, especially firs. In the afternoon we passed Rhododendrons in bloom. At night we had come to a level of about 2,400 feet above the sea,

Our course became during the day much more southerly than before, say south-south-easterly.

28th July.—This day the country we passed through, the rocks, and the timber were much the same as the day before; and our speed likewise. We soon passed traces of Ainos' hunting camps and an Aino fishing apparatus like an eelpot. About eleven o'clock the (for once) welcome sound of the barking of Aino dogs was heard a little in advance. It turned out to come from an Aino's house near the river, at the end of nearly four miles (1½ ri), and we stopped for an early lunch (the Ainos seemed fond of lunching very early), while we gathered some information from the man of the house. He told us we were not on the Tokachi river at all, as we had been trying to believe, still less on a northern branch of it, as we had supposed at first; but that we were on the Otopchi a south-western branch of the Tokachi and separated from the branch stream we had aimed at by the main river and by a large parallel branch. Here was an enormous error of at least fifteen miles in Matsura's map; and a thorough confusion of the courses of the rivers. The Aino said our boats had gone up to Kuttarushi, as expected, but that we could not go there across the mountains; that following down the Otopchi we should come to the Tokachi near Satsunaibuto (where there would be boats), four days' journey distant. "Four days!" at the end of seven or eight days, and we had thought to crosss from boats to boats perhaps in five days; could we not by hard work arrive a little sooner? "Oh, yes; in that way it would take but a day and a-half." That was an encouraging change, and we were sure that he had never known such hard work as we habitually did. So we counted on reaching the Tokachi by the next night, and started off at noon. He went with us at once as guide. His chief luggage was a bow and a quiver of arrows; for Ainos still use the bow, although some have matchlock guns.

I was told at the same time that we had only four day's food left, probably by careless measurement twelve days' rice had been eaten in eight. Henceforth the rice was to be strictly measured, and we should have just enough; for from Satsunaibuto it would be but two days by boat to the sea shore. The Otopchi river was so shallow in places that there was not a boat short of the Tokachi. As the Otopchi was wrongly written on the map, and as we had but few words from the Aino through an interpreting Aino, we got the impression that we were in the Satsunai valley quite on the other side of the Tokachi; far to the south. That was confirmed soon by our coming to another Aino house on a brook called Yuunai, a name that we found on the Satsunai, and it seemed quite near to the Tokachi. We went on then in fine spirits. The Aino led us by a good path which cut across the long bends of the river and required little fording. My ferry-man had made his load a light one and induced me at fords to sit on top of it with my legs over his shoulders, so as to save him the trouble of crossing twice. At about three miles (1.2 ri) from the first Aino house we came to some falls or a cascade of the river perhaps twenty-five feet high in a very narrow rocky gorge. We forded below in deep swift water, and soon had to climb high up a mountain side, perhaps four hundred feet, by a rough, steep path. At length much fatigued we reached the river again, and on the way across it pitched our camp on a large island in face of a cliff of light-gray volcanic rock some forty feet high. We had gone about $9\frac{1}{2}$ miles (3,8 ri). On inquiry in the evening of the Aino guide we were disappointed to learn that we had not yet after all gone one third of the way from his house, only about one quarter, and that our loaded men could not reach the Tokachi the next day, though an unloaded man could. It was clear then that

we must go hungry for a while before reaching the sea shore.

29th July.—We crossed the river and leaving it at first some distance on our right passed over the low sides of some hills. At the end of about two miles we came to an Aino house that appeared deserted for the day at least, and right after that came to a large prairie and the brow of a bluff some fifty feet high near the river. The path henceforth was very good though narrow, and almost always in such a prairie, oftenest on the brow of such a bluff. The prairie was not always quite free of trees, but had scattered trees, and often very open grassy groves or small clumps of light oaks. The grass and weeds were not very high, say three feet, perhaps owing to the comparative dryness of the upland, but near the river were smaller prairies with taller grass and weeds, and perhaps fewer trees.

Towards noon we crossed the river, and keeping near it for some time rose to the upland again, and lunched at a large Aino house there. Then we went along again on the brow of the bluff with fine views of a wide plain to the left with scattered trees, and of not very distant high mountains on our right having their southern end nearly opposite to us. Our course at the last fording had become southerly, and after luncheon south-westerly. At length we reached an Aino village of three houses, Surukonai, at a small brook, and we encamped opposite on the high bank, at the end of a day's journey of about thirteen miles (5.2 ri). We were horrified to learn that it would take nearly all the next day to reach Satsunaibuto, that it was seven ri distant, the next day they said eight; but we put no faith in the measurement.

At this camp we were for the first time this season extremely annoyed by a small black fly.

30th July.—The flies were so troublesome in the

morning that we rose soon after daylight, about half past four, and started about half past six. We began by crossing the brook and then the river, and thenceforth continued on that shore in a nearly south slightly west course. Still we walked through prairies or half open prairies, and commonly along the brow of bluffs, now and then descending to cross a brook. In the forenoon we passed seven Aino houses and stopped to lunch near the last pair of them, at a small stream under the bluff; where, however, the flies again troubled us too much for any good rest. We had come nearly four *ri*, but scarcely half way to Satsunaibuto, and we almost despaired. Still we pushed on steadily with only occasional rests until at six *ri* or more we came to the top of a (70? foot) high cliff above the river. Soon after, we came down from the bluff into some woods and rested at a brook, and were told it was now but a very short distance to the big river. So we worried along almost dead with fatigue, and soon passed an Aino house where a venerable looking man with a long white beard said something to our guide, but seeing the rest of us following, turned, and entered the house, and left the bamboo curtain hanging before the door. The house then looked as deserted as many we had passed, which were perhaps after all likewise inhabited; for the Ainos in the backwoods, whether from scorn, or fear, or politeness, showed but little curiosity in regard to such strange sights as were passing. Soon after that, we came to a good-sized river, probably the Otopchi, and here I expected to camp having had enough exercise for the day; but they insisted that the distance to the big river was only what we had come from the Aino house, so I moved along. It turned out nearly four times as far; and this was but the last instance of many in which we had been lured on by inexact statements; if we had known the real facts we should

perhaps have despaired sometimes. We finally reached the river (passing on the way another Aino house, the thirteenth we saw on the Otopchi), and I was close behind the guide; but there I dropped on the pebbles of the beach almost dead with fatigue. Satsunaibuto was still half a *ri* further on, but boats could pass where we were, and we went no further. We had come 19½ miles (7—8 *ri*). How the Ainos could carry the loads they did such a distance was a mystery to me.

I did not commonly walk at the head of our column; but generally in the woods walked in the rear and the Japanese along with me; for the feet of fifty men made a comparatively good path where none had been before. It was rather a picturesque sight to see such a long string of men with all manner of different loads and rigging and dress, and almost every degree of undress, moving through the woods or prairies. The servants, coolies and Ainos all carried long staves, sometimes replaced by an Aino bow or by a fishing pole, or a level rod. The Ainos had their burden hung on their back by a broad band across the forehead, often bound upon a rectangular framework of sticks and with cords across the breast. The appearance of your humble correspondent must have been as striking a part of the procession as any. He might be seen with weary look bearing the burden of a satchel crammed full of pocket instruments, maps, note-book and many other things handy for use on the road, also with the compass in the open leather case of the spy-glass hanging on his breast by a strap round his neck and tied by a string round his body. His habiliments were decidedly dilapidated; his head was bare, for a black felt hat had proved quite too hot at the beginning of the foot journey; his hair consequently more or less dishevelled by the limbs of trees that brushed it; and in his hand he carried a foreign umbrella that became gradually more and more

tattered from contact with the stones and bushes, for it was used almost wholly as a cane and seldom opened even in sunshine until we reached the wide prairies of the Otopchi. Indeed since that practice I go for hour after hour bare-headed in the hottest sunshine without special discomfort.

It was not often, however, that we formed one single procession; for there were independent spirits that thought they could improve now and then upon the route chosen by the leader; and even on the Otopchi path, where there was no choice, one man after another would stop on the pretext of tying his sandal and rest a while, and so the party was soon after starting broken up into groups. The stragglers were sometimes more than an hour later in coming into camp at night.

Such a raft of companions, however, a respectable village in themselves, everywhere in sight or in hearing, always took away that impression of solitude that we must have had otherwise on the upper rivers.

We learned at the camp that no practicable boats could be had; but some Aino messengers we had sent in advance had gone six ri up the river to an Aino village where boats could be borrowed, and would probably return by the next noon. I was told that we had three days' food left; by what hocus-pocus I never understood. We had been making great exertions to avoid fasting more than a day or two, and yet there was plenty of food to spare. The overland journey had taken just ten days; and we rejoiced that no serious accident had happened.

The nearly open prairies we passed through on the Otopchi must have averaged at least two miles in width with a length in all of about thirty miles, making an extent of sixty square miles or say forty thousand acres.

At our camp again the little black flies were worse than

ever, and seemed almost as capable of enduring smoke as we were ourselves.

31st July.—The day was chiefly spent, while impatiently waiting for the boats, in fighting with the flies and in vainly trying to rest. It was a sultry dog-day.

In the course of the day the Ainos seemed to recover from their fatigue and grew more noisy. In the evening, one party of them (for they commonly encamped separately according to the place they hailed from) renewed an entertainment they had not for a number of days indulged in. It was the intellectual one of chanting a poem. The chanting is done by one man, while at least two beat time loudly with sticks. Although a very interesting matter and no doubt highly intellectual it has at a little distance a very monotonous sound and becomes then very tedious. Yet it is sometimes kept up until 11 o'clock at night, without, however, preventing the participants from rising as usual at half-past four or five. The Ainos indeed seem to need but little sleep; and the digesting and assimilating powers of their stomach are so good that they require only half as much rice as the Japanese coolies (one half a *sho* instead of a whole one) and that without making up for it by eating more fish or meat. Moreover, several accidental observations of Aino fæces (*nil humanum mihi alienum*) showed them to be always quite small.

1st August.—The morning was mostly spent in the same way as the day before. The twenty Upper Ishcari Ainos and the cooly interpreter were sent back by the road we came. There was rice enough for that, for our Tokachi boats had left some at Satsunaibuto. Some of the Ainos came to say good bye and stroke their beards; particularly the wounded man with his hand laid on his nearly healed wound and with a smile of gratitude on his face; much more than I had thought of expecting. Their interpreter had already had the new

names of the streams and places of the Ishcari headwaters explained to him, and a rough sketch given him, so that the Ainos should know the places by their right names.

There was plenty of rice now, to be sure, but the other articles of food to which my assistants and I were accustomed began to run short. In my case, however, they were pretty satisfactorily replaced by vegetables from the Aino village near by, not vegetables cultivated by the Ainos, for they cultivate nothing in these forest settlements. The forest is their garden and yields them not only meat but vegetables, and throughout they reap where they have not sown. There was in particular a kind of wild lily root that tasted much like the common lily root, but was larger, slightly bitter and mealy, and it made a pretty good substitute for potatoes. Then there were burdock roots and one or two other delicacies. It is a great wonder that my special supplies had in general held out so long, for ten days before the boy had said in apology for the absence of some accustomed article that they had been told in Sapporo to provide for thirty-five days only; whereas the time really calculated on in Sapporo was seventy-five days, including twenty-five for the foot journey. It took us in fact forty-five days until the arrival of our boats on the Tokachi.

Early in the morning ten of our best Ainos had been sent off on foot up the Tokachi to find the boats and hasten them along. At noon they came back with the boats that had gone up the Tokachi for us and that had been able to go only six ri higher than our camp. From there parties had been sent up several streams with food to look for us, and there had been some delay in getting word to some of these men, some did not reach the sea shore until several days later than we did. With the boats came the Japanese cooly who brought our spare luggage from Sapporo to the Tokachi, and who had had

charge of the Ainos of the Tokachi expedition. He looked so grand that I mistook him for some yakunin. He brought a number of letters.

As soon as we had lunched and read our letters we embarked, and before night went about five miles (2 ri) down stream to Tobetsu-buto, opposite an Aino house. The lower half of that distance was very difficult; the river was much broken up into small channels, and our way led through one that was extremely narrow and shallow, so that the boats had to be hauled one at a time over numerous shallow places, and after a while even had to be unloaded.

It was not until this evening that the real position of the Otopchi river dawned upon me, so firmly rooted had the wrong impression become; and my two assistants were also mystified until I explained it to them at Ohotsunai.

The woods near the river were very light all the afternoon. The country was flat. Our general course was south-easterly.

2nd August, Sunday.—We had been told that by starting very early and working late we could reach the mouth of the river (Ohotsunai) in one day. So we started at a quarter before six; and the Ainos were allowed to stop to rest only at noon (not as they used to on the Ishcari every hour or so for a quarter of an hour). In that way we reached Ohotsunai by half-past four, a distance of 18½ miles (7.3 ri) by my sketching. We found many very gross inaccuracies in Matsura's map; for example, we were surprisod to hear the surf close by when by his map we should have been half a dozen miles or more away.

The general course was south-easterly, but with great bends and many small ones. The country was flat with a few low (100? foot, 40? foot, 15? foot) hills towards

the sea; and there were many large open prairies; the woods were light, commonly mere brush.

About 2½ miles (1 ri) above Ohotsunai we passed a cliff some 50 feet high of nearly level green sandy beds with an irregular bed of lignite some two or three feet thick near the bottom; but it seemed too thin and impure to work. We saw on many pebble beaches bits of such lignite, but nowhere traces of coal. Special search was not only made at noon, but just below the mouth of the Tosbibets, a considerable branch on our left (500 ? cubic feet a second).

In the course of the day we passed no less than about 36 Ainos houses. Indeed this valley seems far more populous than the Ishcari above Sapporo. Many canoes were seen along the shore, and near the water's edge many whittled sticks. In one place 25 of them were so arranged in a row as to show a special regard for the numbers three and nine. Three large sticks were separated from are another by two smaller ones on each side of the middle one, and the row was completed at either end by nine more of the smaller sticks. About a mile and a half above the river's mouth was a small Shinto temple which must be for the use of Ainos.

At last we reached the village of Ohotsunai on the seashore, only a couple of Aino houses and one Japanese dwelling, the honjin, though there are several large store houses and perhaps empty dwellings. It was a great novelty to us to enter a house once more; and the clean honjin seemed most luxurious.

We stayed two days at Ohotsunai and on the second before our twenty-six Ainos started homeward I made some measurements of their bodies and record of their features, although quite inexperienced in such matters and perhaps quite wrong in the choice of parts to measure.

It was surprising to see how many of them were partially or wholly bald, and (though they are reckoned by the Japanese as so very hairy) how many were naturally comparatively free from hair on their faces and bodies. Their shortness too was striking; on the average only five feet and a quarter, varying from 4.80 feet to 5.71 feet; the latter(5 feet 8½ inches) being my gigantic ferryman. Their ages varied from fourteen to forty-one, with an average of twenty-nine; but in most cases they did not know their own age exactly. The fourteen-year-old lad was about full grown, but slender; he did a man's work with great ambition, and in fact seemed older, say seventeen. Even when the loads had become lighter on the Otopchi he must have carried one half of his own weight or more. The average weight of the Ainos (with their light clothing) was 141 lbs., varying from 108 lbs. (the boy) to 183 lbs. (the ferryman). In general, their hair was thick with a tendency to stand out all over the head. The forehead varied from low to high, commonly of middling height; it was always round. Their brows were very overhanging; their eyes commonly of middling size and always black; their cheekbones were rather high; their nose, commonly with a very low bridge and with broad nostrils, was oftenest turned up, but sometimes straight; their mouth, lips and chin, commonly hidden by the beard, seemed to be of middling character, the mouth not very small, the lips, as compared with Europeans, not unusually thick, and the chin not very large, perhaps even rather small. Of three, who had received special compensation and were therefore bound to submit to anything, we took a number of other dimensions. Their average age was twenty-six, height 5.46 feet, and weight 161 lbs. Their heads measured on the average from front to back 0.68 foot; from side to side 0.55 foot; and from chin to crown (or, rather, vertical height) 0.77 foot; from chin to mouth 0.16 foot. The facial angle was taken very imperfectly, but seemed

to be about 65 degrees. The upper arm measured on the average 1.08 foot long; the forearm 0.83 foot; the hand from the wrist bone 0.66 foot; in all from shoulder to finger tips 2.57 feet, a rather unusual length, I believe, for Europeans of their height. The average length of the leg down from the hipbone (taken by mistake instead of the joint) was 3.10 feet or probably the true length of leg 2.70 feet of which 1.14 feet was thigh, and 1.56 feet (measured) foot and leg below the knee. The foot averaged 0.85 feet long by 0.37 feet wide and the heel was always short. The shoulders averaged 1.46 feet in breadth, the neck 0.20 feet in length, the body from shoulders to hip bone 1,60 feet, or to hip joint probably 2.00. But their muscles were the most striking feature from their enormous size. The men seemed one mass of hard muscle, and in feeling for the hip bone I could not perceive it even when they pointed out its place. Around the chest they measured on the average 2.99 feet; around the upper arm 1.04 feet; fore arm 0.97 feet; wrist 0.56 feet; thigh 1.76 feet; calf 1.26 .feet; ankle 0.86 feet. A few other measurements were also taken, but probably less important ones.

As to the size of their muscles and their weight, it may be well to bear in mind that they had just come in from a fatiguing, wearing trip. Perhaps not so to them, but the scales gave my own weight so very low 116 lbs. (20 to 25 lbs. less than my usual weight, and less than I have known for some 25 years), that they seemed certainly very incorrect, until afterwards there came an opportunity to test the matter and they proved quite exact. As my bones had of course not lessened in weight, the wonder is how the remaining muscles managed to drag them over the mountains as well as they did.

I had no opportunity to take the dimensions of any Aino women, although on the way down the Tokachi an

elderly Aino woman along with Aino men of the neighbourhood helped to pull the canoes over the shallow places. In general, however, whenever we met with Aino women in the wilderness, they crouched on the ground, half averted, and covered the lower part of their face, as if almost consciousthat their tattooing round the mouth was a frightful disfigurement. Their shortness of stature was even more striking than the men's, and the features of their face commonly small and delicate, and not seldom well-shaped. Their dress seemed to be the same as that of the men. They are said not to use chop-sticks in eating as the men do, but to eat with a wooden spoon instead, and I have seen some such spoons quite prettily carved. What can be the cause of such a difference of custom, or why the women should be so far in advance of the men in this respect, are matters for speculation. Possibly the use of a spoon with a heavy Aino moustache may have its inconveniences as compared with the use of chopsticks. The men use also a stick shaped somewhat like a small paper cutter, for raising their mustache while drinking wine. Wine-drinking, by the way, is considered their great weakness, and we carried kegs of wine for them, because they will go nowhere without it, as it is said.

Our Ainos submitted very patiently to the measurements contrary to the expectation of my Japanese assistants; but we began very gradually, and took their height and weight first, about which they had some curiosity themselves; and we began, too, with those who had been paid extra for other things and could not object. As an encouragement, too, in the midst of the work I showed them some of the so-called Pharaoh's serpent's eggs, which on being burnt produce such a long serpent-like mass of ashes. The Ainos did not seem in the least awed by such a miracle, but were greatly interested and amused, and laughed heartily. They laugh

indeed on all occasions, when they catch a fish, and when they fail, when they catch a fawn in a bushy swamp, when they try in vain to make a water-fly go under the water, when they succeed or fail in their games, in short, whenever there is anything either exciting or interesting as well as amusing.

As for awe or superstitious dread, it seems rather foreign to their nature. Although they set up whittlings for some religious purpose, they seem to attach no great sacredness to them; at any rate the ornamental whittlings put at the end of a canoe were sometimes in joke disarranged by the Ainos of another canoe.

The imperturbable good humor of the Ainos seems a remarkable trait. They were constantly full of practical jokes, spattering water on each other in their canoes and playing all kinds of tricks at one another's expense, and always in the best of humor on both sides. Only once did the teasing go so far as to call forth a serious return, and that was from the fourteen-year-old boy, and he was almost instantly shamed to silence by his comrades.

There seemed to be a great uniformity in the taste and acquirements of the Ainos, far more than in the same number of civilised men, still more of educated men, though all educated in the same school. They seemed to differ chiefly in the amount of bodily strength, and to differ in this respect from each other far less than from other men. Is it perhaps that the weaklings and those that have by nature unusual tastes, die young? or is uniformity in a very limited training necessarily very uniform in its results, and are idiosyncrasies comparatively late in showing themselves in the development of the mind? The embryos of different races of animals are said to resemble each other the more imperfect their development. All the Ainos

seemed equally to understand all the affairs of backwoods life, and whenever they worked together at any thing it was with a common understanding without instructions from one to another and often without words of any kind. They seemed at such times to be governed by a "gregarious instinct," and to co-operate much as bees or ants do without intercommunication. It was much the same also in respect to work quite new to them, such as tent-pitching; for there was no sort of method with them, and instead of each one's confining himself always to one small part of the work and learning it thoroughly in two or three days (as I recommended), each one commonly undertook each time any part of the work that came first to his notice; so that after a while they all knew all parts of the work about equally well.

The Ainos show great skill and taste in carving their pipe sticks, cleaver scabbards and other wooden utensils, and whenever they shall become civilized will no doubt astonish the world by their sculpture. This striking point first led me to think they might be of the same race as the Papuans whom Wallace describes in the book we were reading last spring; and there seem to be some other points of resemblance. Their laughing habit is one, their mop head another. Any difference of shade in their complexion could be accounted for by difference of climate. The Ainos complexion seems to me that of a white man (myself for example) well tanned, only still darker in shade, as if still more thoroughly tanned; there is no trace of a Chinese yellow tint, as there is in some Japanese. Within a few days some newspaper account of the aborigines of Formosa and their customs seems to show a great resemblance between them and the Ainos. Perhaps from New Guinea to Yesso the aborigines are all but parts of one race slightly modified by climate.

A few words and phrases of the Aino language that my interpreter had written down did not show the resemblance to Japanese either in structure or in word that I had hoped to find. The dialect changes so quickly from place to place that the Ainos from Ishcaributo and those from Chitose (only fifty miles (20 ri) or so apart) could understand one another only by talking Japanese.

So much for the story of our trip from Kamoikotan to Ohotsunai. Hoping that you may find in it some points of interest,

I remain,
Dear Sir,
Very truly yours,
BENJ. SMITH LYMAN.

OHOTSUNAI TO BIRÔ AND TO NEMORO.

YEDO, 31st December, 1874.

General HORACE CAPRON,
Commissioner and Adviser
to the Kaitakushi.

SIR,

I beg to give you below the daily record of my work from the time of first arriving at Ohotsunai, at the mouth of the Tokachi, until leaving Nemoro ; and so to fill up the only gap left in the whole account of my season's travelling.

The day (3rd Aug.) after our arrival at Ohotsunai I did some rough mapping of the route we had just travelled over ; for the daily fatigues of the march had not allowed the rough map to be finished up day by day as had been customary on the Ishcari boat journey. The same work was continued the next day (4 Aug.) but was interrupted by a trial of horses necessary to a choice of one for me to ride the rest of the season. A large number had been gathered together for inspection, but all were very bad except two or three which were said to be too young. If there were really any good horses in the place,

they must have been carefully kept out of our sight because they were wanted by the inhabitants for their own use. But it is very possible that there were no good ones ; for, since all the horses here, as almost everywhere in Yesso, belong to the Government, they are probably not so well cared for as they would be if in the hands of individual owners. It even seems probable that it would be good policy for the Kaitakushi to give away all the horses to the inhabitants, on condition perhaps that the needful pack-horses for travellers should be furnished at a certain reasonable rate. The animals would then be taken care of with a much livelier personal interest, the country (remarkably well fitted for horse raising) would be greatly benefitted thereby, and the Kaitakushi would no doubt reap many advantages in consequence. At length when the idea had been hit upon of bribing the chief hostler (an Aino) to to do his duty and show us a good beast even at the sacrifice of his own convenience, a much better horse than all the rest (though poor enough) was quickly discovered ; but the bribe was from honesty, misunderstanding or some other cause returned after a few hours.

After the trial of the horses, our Ainos were paid off for their trip across the mountains ; and as they were all gathered together in the hotel yard the opportunity was taken of weighing them and measuring their dimensions with the general result already given. The details of the measurements and observations were as given in the two accompanying tables.

The next morning early (5 August), the Ainos started for home by way of Biro and Uragawa along the coast. Somewhat later the interpreter set out for Sapporo, as already explained in other communications ; and he took with him a pretty long letter that I had written you hastily the same morning about our trip across the mountains. Still a little later Mr. Akiyama and I started and

No.	Where from.	Name.	Age.	Height (Feet.)	Weight.		
					Kamme.	Pounds.	Hou
1	Shizuoi	Chabo	"36"	4.80	16.2	135	Thin, m short
2	"	Atashite	"35"	5.28	17.6	147	Thick, m short
3	"	Yaegoto	35	5.28	16.3	136	Very th and lo
4	"	Chikamukuru	33?	5.07	16.0	133	Very l (side bo
5	"	Shinangoru	33	5.49	18.0	150	Quite t (with s hair.
6	"	Kusarengera	"32†"	5.46	18.6	155	Slightly taut lor
7	"	Ikuyange	"27†"	5.53	17.0	142	Thick not lor
8	"	Yoshimatsu	"26"	5.40	18.0	150	Thick, h
9	"	Shussa no Aino	25?	5.74	22.0	184	Thick, h
10	"	Shokubashite	"23"	5.40	18.0	150	Thick, h
11	Chitose	Honinaku	35?	5.37	16.2	135	Nearly t
12	"	Patekuwengoru	"28"	5.35	18.0	150	Rather st long.
13	"	Ibitsiba	"28"	5.22	16.4	137	Thick, sl short
14	"	Naoba	"28"	5.20	16.0	133	Thick, h
15	"	Jumutoku	25	5.34	18.0	150	Thick, h
16	"	Pashikuro	22†	5.28	17.4	145	Thick
17	"	Yukepashto	21?	5.22	16.0	133	Thick
18	"	Krotokuru	"16"	5.29	17.0	142	Thick,
19	Ishcaributo	Okonokara	40?	5.22	17.0	142	Extrem bald.
20	"	Yonde	34?	5.06	15.4	128	Rather t short
21	"	Tetta	28	5.37	18.6	155	Thick, s torso lengthy
22	"	Nisago	26?	5.33	15.4	128	Thick
23	"	Kinshuku	26	5.18	13.8	132	Thick
24	"	Fuyari	25?	5.11	16.4	137	Thick
25	"	Taro	23?	5.05	15.8	132	Rather t
26	"	Irakichari	"13†"	5.16	13.0	108	Thick l

	Number.	9	16	21	Average.
	Name.	Shussa no Aino.	Pashikuro.	Tetta.	
HEAD. Lengths.	Facial Angle,	56° (fore)	69°? (fore)	68°? (fore)	62.3° (fore)
	Front to back,	0,70	0,67	0,68	0,684
	Side to side,	0,54	0,56	0,56	0,553
	Chin to crown,	0,85	0,79	0,68	0,740
HEAD. Circumferences.	Brow to neck,	1,30	1,35	1,35	1,333
	Ear to ear,	1,30	1,28	1,20	1,260
	Chin to brow,	0,45	0,45	0,45	0,450
	Chin to mouth,	0,15	0,16	0,18	0,163
ARM. Length.	Arm,	1,20	1,05	1,00	1,083
	Forearm,	0,90	0,80	0,80	0,833
	Hand,	0,68	0,64	0,65	0,657
	Breadth of Hand,	0,33	0,30	0,30	0,310
ARM. Circumf.	Arm,	1,08	0,94	1,05	1,023
	Forearm,	1,05	0,94	0,93	0,973
	Wrist,	0,59	0,53	0,55	0,557
LEG. Length.	Hip,	3,26	2,98	3,07	3,103
	Knee,	1,05	1,27	1,20	1,173
	Breadth of foot,	0,40	0,35	0,35	0,367
LEG. Length.	Foot,	0,90	0,79	0,85	0,847
	Heel,	short.	short.	short.	short.
LEG. Circumference.	Thigh,	1,77	1,65	1,85	1,757
	Knee,	1,25	1,10	...	1,175
	Calf,	1,29	1,20	1,30	1,263
	Ankle,	0,87	0,80	0,90	0,857
BODY. Length.	Neck,	0,20	0,20	0,20	0,200
	Body,	1,80	1,35	1,65	1,600
	Breadth of shoulders,	1,53	1,40	1,46	1,463
BODY. Circumf.	Neck,	1,25	1,21	1,20	1,220
	Chest,	3,15	2,84	3,05	3,013
	Waist,	2,82	2,70	2,60	2,710

REMARKS.

The average age of all was 28† years; of Nos. 9, 16, and 21 was 25† years.
" height " 5.280 ft.; " " " 5.463 ft.
" weight " 141.1 lb.; " " " 161 lb.
" " " 16,927 mes; " " " 19,333 mes.

No. 9 was the gigantic ferryman. No. 16 knew something of Japanese reading, the only one of them who did. He was employed as an aid to the Japanese servants besides his other duties. No. 21 was last year my favorite Ainu in the Horonai coal survey; and this year was my chief boat man, but did not bear out his last year's reputation. No. 17 gave his age as 11, but had apparently made a mistake of ten years, and was well laughed at for it. No. 20 seemed older, say 47. No. 19 also seemed older. The ages are given in foreign style, one year less than the Japanese reckoning. Most of the Ainos did not know their own age, but it was commonly stated rather positively by one of their party.—The facial angle was very poorly taken.—The weight includes the light clothing the men wore.—The length of head from front to back was the horizontal distance; from chin to crown, the vertical distance.—The length of leg was by mistake measured from the hip bone instead of from the hip joint and was therefore probably 0,4 foot too long. In like manner the length of body was taken from the shoulder to the hip bone; and to the hip joint was probably 0,4 foot more.

rode to Berufune, nineteen miles and a half (7.8 ri), on the way to Biro, southward along the seashore.

The first half ri or so was level and but few feet above the sea, a part of the alluvial plain of the Tokachi River. But then the road, keeping along the beach, lay at the foot of bluffs of some fifty or seventy-five feet in height, of which the upper third was a buff sand rock and cliffy, while the lower two-thirds were of dark clay or shale and grassy. Near the beginning there was a gentle dip, perhaps 5 degrees southerly; but afterwards a still gentler one, perhaps 3 degrees northerly. The rocks seemed all to be of the same age as those which on the Tokachi river near by contain beds of lignite, as already mentioned and to belong, therefore, without a doubt to the Toshibets (Karafto) group, that they otherwise very strongly resemble.

The last third of the way (from Tobui) the road was chiefly on the plain at the top of the bluff. The land further back from the shore rises gently into low hills. At the mouth of the Ayoshuma brook, about half-way from Tobui to Berufune, we passed a place where gold was said to have been washed, especially at the time of Mr. Enomoto's visit last year, and the place had the best reputation of any in the whole region as regards richness in gold. It was said, however, that some Hakodate merchants began systematic washing here three or four years ago, but soon found it did not pay and gave it up. Since my passing the place Mr. Munroe and his party came there to make a survey, and washed large quantities of the gravel without finding more than a mere trace of gold; and he was convinced that deception had been practised by the men who did the washing last year. The gravel is at the foot of the bluff close by the brook and the sea beach, and is made up chiefly of coarse (fist size) pebbles of metamor-

phic rocks, especially blue slaty quartzite, and some large gray syenitic or granitic pebbles and a few of white quartz.

The same bluffs continued all the way to Berufune with a number of small breaks in them where small or large streams came down to the sea. At four or five such places there were lakes, two or three quite large ones, separated from the sea only by a narrow low bar of sand, which in some cases completely closed the mouth of the stream. It is quite possible that some of the lakes might be easily made into good artificial harbors, whenever there should be a sufficiently strong demand for such maritime conveniences.

The land was open and covered with short grass at the bluffs near the sea shore, but a few hundred yards back there were high open oak woods, without under-brush but bordered by very low, stunted oaks. The vegetation near the shore was not luxuriant, but the soil seemed moderately good, a light gray, rather sandy, fine loam which packs into a good hard horsepath.

There was scarcely a dwelling house in the whole distance, perhaps an Aino hut or two at Tôbui (two ri short of Berufune), at the place where the ruins of an old honjin are still to be seen. At Berufune besides the new unfinished hotel there was no other Japanese dwelling, but there were a few Aino houses. The hotel is near the bank of Berufune river in an alluvial plain a quarter of a mile or so from the sea.

The next morning (6th August), we rode to Birô, twelve miles and a half (5 ri). The character of the country, of the rocks and of the vegetation was throughout much the same as the day before; but the road kept along the top of the bluffs or several hundred yards inland, and the upland was interrupted not only by small ravines along the sea shore, but about once in a ri by a valley

several hundred yards wide containing a river with small side channels besides the main one. The bluffs at first were fifty or sixty feet high; at Birô and near it about seventy-five feet high.

Immediately on starting we forded the Berufune river with its three or four channels separated by broad, low, brushy islands; the main channel was some fifty yards wide and a couple of feet deep with an average current of perhaps two feet and a half a second; and with a discharge, including the small side channels, of perhaps four hundred to five hundred cubic feet in a second. We understood that Messrs. Hirano and Ishikawa last year tried some places up the river, perhaps half a mile from the sea, for gold and found a little. Gold was also said to have been found on the Rakko river, one ri short of Birô, but equally little with Berufune. Mr. Munroe's washings at both these places later in the season were also as discouraging as at the Ayoshuma. No other places hereabouts were reported to us as having any gold at all. The pebbles at the ford of the Rakko River are chiefly bluish, rather coarse quartzite (fist size), blackish, fine-grained quartzite with fine white veins (large egg size), light gray syenite (about half-a-foot thick), a few white quartz pebbles (large egg size).

The village of Birô is built on the plain at the top of the bluff and proved to consist of the Kaitakushi office and the officer's dwelling, the hotel, one other Japanese dwelling and 45 Aino houses. The Ainos have been encouraged to cultivate some ground.

Mr. Sakai, the Governor of the place and of the Tokachi province, said he had travelled much into the interior, and, for example, had crossed from the Tokachi by its branch the Saoro to the Sorachi by a very low, easy pass, and had gone still further to the head waters of the Yubaribets. He had made rough maps of that and other

parts of the country that he had traversed. It is probable that, although such maps are far less perfect than those of instrumental surveys, yet they may furnish the means of correcting to some extent such maps as Matsura's, which was probably compiled originally from just such materials, and in those far inland places very likely from still more imperfect sketches. We therefore seized the opportunity of making some hasty copies of the maps, and the work busied Mr. Akiyama until we left Birô; my intelligent attendant, Mr. Isami Nomura, also kindly lent a hand to such work, although it was outside of his required duties.

Meanwhile I was myself occupied in writing the rough draft of the account of our trip from Kamoikotan across the mountains to Ohotsunai. These labors employed us busily though the rest of the 6th, the 7th, 8th, 9th (Sunday) and 10th of August.

On the 7th, I took the latitude of Birô with the pocket sextant by the sun's height at noon, and found it to correspond exactly with what is given on Matsura's map. Some other maps of Yesso place the region of Birô much too far to the north.

On the 8th towards night we visited, on the left bank of the Birô river, a hundred yards above its mouth, an exposure of green quartzite so much mixed with calcite (partly in small veins and seams) as to seem like an impure limestone. It was in a cliff some 25 feet long by 20 feet high, and the thickness of the bed exposed was about 20 feet. The beds were mostly thin (about a foot), and the rock is extremely broken up by small, short cleavages in every direction so that it could hardly be a good building stone. The dip was 70 S. 75 degrees W. The rock belongs, I doubt not, to the same group with the dark quartzites of Kamoikotan. The pebbles of the Birô river are chiefly of metamorphic rocks and

in great part the dark blue quartzite so often seen since our reaching the Upper Ishcari. There were also pebbles of two or three slightly different kinds of granite with no visible hornblende, but with blackish mica and besides that in one case a light colored mica too.

We were shown a specimen of brown hematite, a very thin layer upon a piece of dark metamorphic (micaceous ?) sandrock, said to come from Tanneesho, five ri south-westerly from Birô ; also a large hand specimen of a vein of white dolomite 0 ft. 15 thick found somewhere in the neighborhood of Birô. Both were too small to be of any value, and if they had come from large deposits, better specimens would probably have been found and preserved.

On the eighth also some horses were brought us for the trial and one was selected as a substitute for the one chosen at Ohotsunai which had proved to be too small and weak. The new horse went with us to Hakodate.

The early morning of the 11th of August was spent in writing a letter to you and instructions to Mr. Munroe, whom we had hoped to meet near Birô, but of whose approach no tidings had yet come. Near eleven o'clock, however, Mr. Akiyama and I set out on horseback for Ohotsunai again, 32 miles (12.8 ri) ; and by some mistake the baggage was equally late in starting.

About half way between Biro and Berufune, at a spot called Betsubets, some bits of coal (as we learned at Birô) had been found, and they were shown to us. They were much rounded pebbles of good looking coal, like that of Poronai for example. In passing the place so marked on the map, it appeared to be merely a gully scarcely a hundred yards long filled with grass, weeds and pebbles apparently from the Toshibets (Karafto) group, but without any exposure of rock in place. There is no reason whatever to expect to find productive coal measures there.

On reaching the main channel of the Berufune river we found it much swollen, and rising rapidly with dark brown muddy water, a swift current and much floating driftwood. The stream was indeed too deep to ford with safety and we had to cross in canoes. The rise had been remarkably sudden and was the more striking because there had lately been no rainy weather along the sea shore such as could have caused it. It was said, however, that like freshets took place whenever the wind blew from a certain direction. A warm wind might have melted snow in the mountains and might have caused rains there; and that must be the true explanation, though no high mountains were in sight. Probably the stream rises far back, in the region of the very high snowy mountains that reaches from Tokachidake to Yubaribetsudake.

On the trip from Ohotsunai to Birô and back, having now given up boat and foot travelling and taken to riding, the sketching hitherto practised was replaced by rough sketches of the topography from horse-back. The Birô horse proved to be so steady that it soon became unnecesssary even to stop him for the purpose; but the pencil could only be used from time to time at intervals of a few minutes, or in a very uniform region even less frequently, trusting to the memory sometimes for what had already passed out of sight. Such sketching was kept up throughout the rest of the season until the very last day; and the note books of the whole journey now recall all its topographical features, which would otherwise have often slipped completely out of mind. Every rock exposure also found its place in the main sketch and did not require a special drawing.

Having on our return little to delay us, except the noon meal and a little rest at Berufune, we reached Ohotsunai about six; but waited long in vain for the

servants and baggage, and finally gave them up. Hardly had we gone to bed, however, when they arrived a little after ten, having been delayed at the swollen river still more than we were.

The next day (12th August), we rode to Shirauuka 30 miles (12 ri), on our way easterly along the coast towards Nemoro.

The first ri and somewhat more lay along a beach and sand bar that stretches from the ferry at Ohotsunai to the one near the hamlet of two Aino houses called Tokachibuto, by the eastern mouth of the Tokachi. On our left were broad low grassy islands with some brush or light woods far back. After crossing the second ferry we passed at once over a lightly wooded narrow headland some 60 feet high. The surface of the hill is said to have upon it many holes which the Ainos suppose to have been dug by dwarfs, a race whose existence they believe in. At the time, however, we were not on the look-out for the holes, and did not notice them.

After coming down from that hill we rode all the rest of the way along the beach, almost always under cliffy bluffs of 60 to 100 feet or more in height. At first there was at top a layer of brown gravel 5 to 20 feet thick, and below that to the sea level seemed to be nothing but gray clay wet at top with water draining from the gravel and also grassy, both the gravel and the clay there seemed to be about level and conformable to each other. Within about a ri, however, the lower gray beds, perhaps 50 feet thick took gradually a decided dip of as much as about 10 degrees southerly (or southwesterly ?) while their upper edge remained level and was still covered, but unconformably, by level beds of brown gravel some 30 feet thick, evidently the bluff deposit quite distinct from the lower beds which seemed to be of the Toshibets (Karafto) group. Half a ri further

on, the dip of the gray beds became some 25 degrees westerly. Still another half ri, and the dip was 10 degrees easterly and the bluff perhaps 100 feet high with dark gray sand rock some 10 feet thick near the top and the rest light gray shales. A few hundred yards beyond that the dip was some 7 degrees easterly, and the rock chiefly light gray shales and a few layers of brown, especially near the bottom. A few hundred yards again brought us to dips of some 10, 15 and 20 degrees easterly; and the light gray shales were again covered unconformably with a level brown gravel bed some ten feet thick.

At length at the end of about eight ri we reached by a ferry the little village and hotel of Shakubets at the far edge of a low, flat, open prairie, half a ri wide and running far back; and there we stopped to lunch. Close beyond, however, the high bluffs and cliffs of gray shales recommenced and continued with a couple of like interruptions and many smaller ones, as before, all the rest of the way to Shirauuka. They were perhaps a hundred feet high and very steep, but mostly covered with grass, weeds and low bamboo, with a few imperfect small exposures of gray shales. Towards Shirauuka the bluffs grew lower to seventy-five, sixty, fifty and even twenty feet; and about a ri short of that place the bluff was grassy with cliffy exposures of brown sand and gravel at top, perhaps twenty feet thick and of gray shales below to the bottom, with a dip of hardly 2 degrees easterly; the bluffs were grassy the rest of the way. The very neat hotel and large Aino village of Shirauuka were at the far edge of another wide, open, low, flat prairie.

The timber through the day was some distance back from the sea, and did not look heavy. The number of dwellings that we passed was very small indeed, and almost wholly made up of Aino houses, scarcely one outside of the villages mentioned.

The next day (13th August), we rode to Kusuri, eighteen miles and a quarter (7¼ ri). The first ri or more was much like the road of the day before, along the beach with bluffs of sixty, eighty and a hundred feet or more in height alongside. Then there was a flat valley more than a ri wide and after it similar bluffs recommencing far back and approaching within half a mile or so of the sea, and continuing parallel to it for another ri or more. The rest of the way, some three ri, was a low flat prairie on the beach alongside, until the large Aino outskirts of Kusuri village and its ferry across a shallow river of perhaps a hundred yards in width were reached and the hotel close by.

About a quarter of a mile after starting from Shiranuka we passed an old coal mine, the first of the coal exposures on this part of the East Coast. The change from the rock we had seen in the cliffs all the way from Birô, and had supposed to be unquestionably of the Toshibets (Karafto) group, to the older coal-bearing rocks in cliffs above the mine was very abrupt and unexpected. But little more than a ri short of the mine we had passed the last exposures of the newer group, gray shales with nearly level dip; and above the mine we found level bedded gray sand rock that at first sight looked much like a continuation of that same group. A closer examination of rock near the mine showed it, however, to be very hard and rather coarse with many black specks in it (perhaps blackish quartzite). The coal mine was worked some years ago and long since abandoned. It seemed to consist of but one drift, at the foot of the bluff, about five feet above sea level. The mouth of the drift was filled nearly to the top with fallen earth, but I managed to crawl into it and for about eight yards along it. There it was so completely closed with fallen earth as to be quite im-

passable; but a strong current of air issued through a small opening still left at the top. As the sides of the drift were lagged it was impossible to see the coal bed at all. The thickness is, however, said to have varied from half a foot to four or five feet. There is a large quantity of the coal still lying in large heaps (perhaps 300 cubic yards in all) near the drift; but mostly fallen into slack though there are still some lumps of good looking coal of fist size. A good deal of slate is also mixed with the slack. The bed, however, even though of good quality, according to the reported thickness of it, could hardly be considered workable. The dip in the cliff just over the coal mines seemed to be about level; but a few score yards beyond, it seemed to be about 3 degrees northwesterly.

After leaving the neighbourhood of the coal mine there were no more exposures of rock in place. Among the pebbles of the main stream of the broad valley that was crossed about midway there was a little coal in bits and one bit of coal slate half an inch long; but most of the pebbles were of metamorphic rocks. The hotel was at the foot of a flat topped hill of perhaps thirty feet in height, and on the steep hill side were a few small cliffs of dark gray apparently sand rock.

Along the road the hills some distance back from the shore were covered with light looking timber and there was some brush in the valley just mentioned; but the rest of the flat land near the sea was open prairie.

There was along the whole road scarcely even an Aino hut, but at Kusuri there were besides the numerous Aino houses a number of Japanese ones, the first signs of the Japanese population at the eastern end of Yesso, isolated on the southwest and northwest by long portions of the coast where almost the only Japanese houses are the hotels and where even the Aino population is small. At Kusuri,

too, a small rocky point gave a little protection to half a dozen junks at anchor. The inhabitants were busy gathering the kombu seaweed, the principal product of the place.

At Kusuri we learned for the first time (in spite of the diligent inquiries we had made as we came along) that about a ri and a half from Shiranuka towards the Tokachi there were two places, Oshishipe and Pashikori, near each other, where a little gold had been found, "but only a very little." So unpromising a report did not seem to make it worth while to give the place a special examination, now that we had passed it so far. We were told also that about eight ri from Shiranuka on the Musaushinai brook, a branch of Kamoichikap river, which is itself a branch of the Shiranuka, there was exposed a round arch shaped saddle in the rocks of which several layers were of coal from one or two-tenths of a foot to seven-tenths in thickness; but most of the rest is clay. A sample of the coal was shown, and it was bright and looked very good.

Information was given us at Kusuri, too, of the coal places we should see on the way along shore to Akkeshi; and of the road across the island to Aoshiri near Shari and of some of its rocks. To go across there by way of the Kusuri River would be 51 ri of which 23 ri would be up the river; and, as there is no road there, the journey could not be made with horses. But from Otanoske, a spot on the sea shore $2\frac{1}{2}$ ri south-westerly from Kusuri, there is an old road to Aoshiri which is 43 ri long. Of that distance the first 18 ri can be travelled with horses; then there is a gap of 7 ri that is now only passable on foot without horses; then 18 ri again to Aoshiri that is fit for horses. Of the whole distance there are 23 ri of forest road, about 12 ri of river bank or dry river bed, about $5\frac{1}{2}$ ri of very good road, about

4½ ri of prairie, about 1½ ri of sea shore, and about 1 ri of small swamps ; and there are 160 streams large and small.

At two ri beyond the end of the first 18 ri of the road, there are some hot springs. At 29 ri from Kusuri on the road, a dark brown micaceous course gritty (perhaps metamorphosed) sand rock is found, of which a specimen was shown and looked, except in color, much like the rock found near the Shiranuka coal mine. At Nishibets, 30 ri from Kusuri on the road, beyond the Volcano Meakan, a dark red porous, rough, light, apparently volcanic rock is found, of which also a specimen was shown ; also, close by, a white rather coarse, rough-feeling sand, perhaps volcanic, of which they showed us a sample.

At Tokotan, two ri up the Kusuri river is found a gray coarse gritty sandrock just like that noticed near the Shiranuka coal mine, and a specimen was shown to us. At 25 ri up the Kusuri River, on the Meakan mountain, at a place called Matsunenobori sulphur is found, and was formerly worked but has long since been abandoned. A sample of it was shown and it was bright yellow, evidently of volcanic origin. Also from a spot called Kutcharo, 30 ri up the Kusuri river a specimen was shown us of a white clay-like mineral that seemed to be an earthy sepiolite. On being put into the water it floats but an instant, hisses, fills its pores with water and sinks. It sticks strongly to the tongue like clay. The deer eat the mineral, and the Ainos do too, it is said. It has in it what appear to be very imperfect remains of insects, wings for example, which burn up in the blow pipe flame.

We arrived at Kusuri at noon, but it soon began to rain so as to prevent our visiting the neighbouring coal places as we had planned.

The next day (14th August) we rode to Kombumori and visited also several coal places more or less near to the road, going in all 11¼ miles (4½ ri). On first starting in the morning we visited the spot called Shirito on the sea shore hardly a quarter of a mile from the hotel, and saw the so called coal there. Although we had heard of the place many miles away it proved to be very insignificant, except as showing how minutely the country was known as regards exposures of anything like coal; for the whole amounted to nothing but a seam of black coal slate one-tenth of a foot thick. It was to be seen at low tide imbedded in a broad reef of dark gray rather coarse, gritty sand rock with a few minute red specks (perhaps of jasper). The dip, if any way was perhaps 2 degrees southwest, but was gentle enough to be the end of a basin. Some 30 yards further from the hotel the dip seemed rather to be north-westerly but was very gentle indeed.

We then returned to the village and fairly set out for Kombumori, crossing within the first half mile a narrow headland by a pass some 60 feet high but with a prairie on either side some 80 feet above the sea. Then we rode along a beach busy with gatherers of seaweed, until at half a ri from Kusuri we left the shore and the road and went half a ri up the left bank of a crooked river; at the foot of hills perhaps 100 feet high. Then turning to the right up a small branch valley within a few hundred yards we came to a new coal opening that two or three men from Kusuri were just then digging at a spot called Harutori. The following section was exposed, from above downwards.

	feet.
Light brown, weathered, coarse, slightly micaceous sand rock, exposed	about 5.00
COAL, merely crop coal and poor looking	1.95
Slate and bony coal	2.25
Dark shales, exposed	about 0.05
	4.25

Of course such a coal bed is too poor to work. A coal bed, perhaps the same one, is opened on the opposite side of the ravine and gives the following section, from above downwards:—

	feet.
Gray sandrock (weathering brown), exposed .....about	1.00
COAL.....	1.85
Gray sandrock, exposed	10.00
	12.85

It is plainly even more unworkable than the coal at the other place, and there is no reason whatever to expect the bed to improve on digging further into the hill. The dip is gentle, but if both exposures are really on the same bed, the dip from one to the other is perhaps 15 feet in 60 feet, or 15 degrees, and the direction is N. about 40 degrees E.

We returned thence to the seashore and the main road by a different path from the one we had come, and passed over gently rolling nearly flat upland covered with thick lightwoods, until we reached wide open prarie land near the sea. A few hundred yards on the main road brought us to the old Osotsunai coal mine, within a few yards of the sea cliffs, about a ri and a half from Kusuri. It was opened by the Public Works Department of Japan in 1871, was abandoned about a year later, and is now fallen in and inaccessible. Some lumps of the coal lying outside look very good and firm, perhaps rather bony in parts. There was in fact a heap of it said to contain 2,700 koku (160 tons), covered with a poor straw roof. Our Japanese guide said the coal was in two benches, the upper one foot, the lower two feet thick, separated by one foot of black slate and covered likewise by one foot of black slate, with soft gray shales above. Counting the layers of slate, then it was reckoned a five foot bed, but yielded only three feet of coal.

The place was reckoned the best for coal in the whole Akkeshi region, and we saw none so good. The mine, as it seems, must have been a slope descending with the coal at a dip of some 20 degrees north-westerly; and must have been troubled with a gathering of water in it unless naturally drained enough by the cliff exposure only a few yards distant.

That exposure along the sea cliffs included not only the coal bed of the mine but one or two others as well as a good thickness of other rocks, and gave the following section, from above downwards:

	feet
Coarse (filbert size) pebble rock with many red, green, dark gray (a few yellow) jasper pebbles, ... perhaps	75,00
COAL (z)	0,60
Gray coarse sand rock ... ... perhaps	20,00
COAL, ... about	0,40
Gray, coarse sand rock ... ... perhaps	3,50
COAL, ...	0,30
Gray coarse sand rock ... ... perhaps	3,50
COAL	0,30
Gray, coarse sand rock ... ... perhaps	3,50
Gray shale	0,03
Coal and black slate mixed	0,60
Soft gray shale	0,55
COAL, hard and poor, with bits of amber in it ...	0,50
Gray sand rock ... ... perhaps	15,00
Gray shales with some hard sandy lumps perhaps	7,00
COAL (good ?) (y)	1,95
COAL, bony... ... ... about	0,40
COAL, good...	0,45
Black slate	0,30
Soft gray shales ... ... about	5,00
COAL, good (y)	1,70
Black slate	0,20

	feet
COAL	0,55
Black slate	0,70
Soft gray shales, ...	0,60
Coal and slate mixed	0,60
COAL, ...	2,10
Slate and a little coal mixed	0,60
Light gray, coarse sandrock, partly hidden at top ... ... perhaps	20,00
Soft gray shales	2,00
COAL, bony	0,60
Soft, gray shales	1,00
COAL, ...	1,40
Black slate	0,70
Coal and black slate mixed	0,20
Black slate	3,80
COAL, ...	0,50
Soft gray shales	0,60
Hidden ... ... about	3,00
Light gray, coarse sandrock	4,00
Soft light gray shales	10,00
Light gray sandrock with about 2 feet of scattered pebbles, walnut size, at some 10 feet from the top	30,00
	220,00

Next to the bottom of the section is a beach, beyond which northeastward the same rocks recur with an opposite dip,

The only coal in the whole section that could be called workable is that which has the layer marked (y) at the top, and which in all has a thickness of 4.35 feet of coal within a thickness of 6.45 feet. But the same bed a few score yards nearer to the mine (which is on this bed) measures as follows, from above downwards:

	feet.
Coal, good	1,70
Black slate	1,20
Coal, good	1,20
Black slate	0,30
Coal, good	0,40
Black slate	0,80
	5,60

At that point there are 3.30 feet of coal within a thickness of 4.80 feet; and the mean between the two places would give 3.82 feet of coals. The upper bench is bright-looking and firm and seems to be of a very good quality. Still, considering the very moderate average thickness of the coal and its variableness, and the lack of good facilities for shipping it (since there is no good harbor nearer than that of Akkeshi twenty miles, eight ri, or more distant) the encouragement for working the bed is not great; and it can hardly be called at best more than just barely workable. Samples for assaying were taken from the upper, main beach. The coal of the layer marked (y) and of the one near it amounts altogether to only 2.35 feet, and is therefore quite unworkable. Two or three of the coal beds contain numerous bits of amber of mustard seed size.

From the coal mine to Kombumori the first half of the road lay chiefly at a few hundred yards distance from the sea on the rolling prairie land at the top of the bluffs, some 75 feet above sea level, and with lightly wooded hills a couple of hundred feet high a few hundred yards distant on our left. Then the road led us down to the beach again and along it under bluffs and cliffs 50, 75 and 80 feet high all the rest of the way. About midway of the upland road we came down near to the sea for a moment at the mouth of one of the numerous small valleys we had to cross; and found there a large rock

with a dip of about 10 degrees seaward and with a hole through it at the bottom. At the point where we finally came down to the beach there was a cliff of coarse, gray, slightly greenish sand rock with a dip of 10 degrees N. 60 degrees E. A few hundred yards further on there were cliffs of gray sand rock with a dip of some 5. degrees N. 80 degrees W. Still a few hundred yards further on there was a cliff with very light gray (weathering buff) sand rock some 30 feet thick above, and a dark gray sand rock some 10 feet thick below having a few scattered pebbles through the lower four feet; and with a dip of 40 degrees N. 60 degrees E. Perhaps a couple of hundred yards beyond that, there were cliffs of gray shales (about six feet exposed) with a dip of only some 3 degrees westerly. A few hundred yards short of Kombumori there was exposed a coarse gray, slightly greenish, sand rock that weathered slightly brown; with a dip of some 5 degrees westerly. Close by, the sand rock was honeycombed. The rest of the way the bluffs were steep but grassy, with, here and there, high up, a small cliff of gray sand rock showing likewise a dip of some 5 degrees westerly.

The village of Kombumori, small as it was, seemed more populous with Japanese houses than almost any we had seen since leaving Sapporo; but all through the day we had found many Japanese houses along the shore wherever a sandy beach gave a little space to dry the seaweed (kombu) that grew abundantly on the neighboring rocky reefs. Especially at Osotsunai, near the coal mine, there was a village of some size.

The next day (15th August), we rode to Chipuran, 6 ri; and went thence in a boat to see some coal at Beshakodomari, $1\frac{1}{2}$ ri, and then across the bay to Akkeshi, making in all $23\frac{1}{4}$ miles ($9\frac{1}{2}$ ri).

Somewhat more than half a mile ("8 chô") along the beach, at the foot of grassy bluffs perhaps a hundred

feet high, and on beginning to pass inland for a few miles, brought us to the Fushikokombumori coal exposure. It proved to be only two-tenths of a foot of bony coal and black slate, in the slipped side of a small ravine near to the sea shore. Below it were exposed about 3 feet of soft gray shales; and above it about 0.6 foot of the same shales; and above that some 20 feet of soft coarse gray sand rock that weathered a very light brown, with a harder band about two feet thick at about five feet above the bottom. Then above that, black slate (with two tenths of a foot of coal perhaps) about a foot thick; and above that again the same soft sandrock exposed about ten feet. About twenty yards further up the ravine (northeastward) two-tenths of a foot of bony coal are again exposed, probably the same as the lower one of the other two beds, and with shales above that are black for the same thickness at the bottom. The dip was about level. Such thin coals are of course not only unworkable, but no sign at all of the near presence of good beds.

The road, then, after going inland over broken but mainly rather flat land, rising to a height of perhaps a hundred and fifty feet above the sea, partly through heavy fir (todomatsu) woods, came down to the beach again at the mouth of a small valley, at Todomap. There was a cliff there of dark gray sand rock perhaps a hundred feet high with a dip about level; also a rock in the edge of the water some thirty feet high and twenty yards in diameter; and a low cliff of coarse gray sandrock, weathering light brown, at the far side of the valley. A few yards beyond, there was a rocky point of light gray, coarse sandrock with a dip of perhaps 5 degrees easterly. Close beyond, there were cliffs with dark gray soft shales, at bottom perhaps thirty feet thick, with a dip of perhaps 3 degrees south-westerly. Then crossing for a few hundred yards the tops of the bluffs 100 to 125 feet high,

with hills a couple of hundred feet high a few hundred yards distant on our left, we came down once more to the beach at Pontomari, called two ri from Kombumori. There was the following section exposed there in the steep hill side close to the sea, from above downwards :—

	feet.
Gray shales, exposed.....about	2,00
Coal	0,20
Black slate and coal mixed	0,30
Gray soft shales	1,80
Coal and slate mixed	0,35
Coal (looks good)	1,35
Black slate	0,55
Coal somewhat mixed with slate.....	1,35
Gray clay or shales, exposed.....	0,10
	8,00

The coal of the two main layers amounts then to 2.70 feet within a thickness of 3.25 feet, and is partly of poor quality ; it cannot be considered as workable at all. On the hill-side near, the same coarse pebble rock as the one found near the Osotsunai coal occurs in huge blocks, as large as a house. It would therefore seem probable that the Pontomari coal and the Osotsunai coal are the same ; but the accompanying thin coal beds do not seem to be exposed and perhaps have thinned out. The top of the section is perhaps fifty feet above the sea. The dip was about 10 degrees S. about 70 degrees E.

The road from Pontomari to Chipuran lay for the first half of the way still along the sea beach under bluffs of perhaps 100 feet in height with many dark gray cliffs and sand rock exposures. The dip was very gentle, perhaps 5 degrees at first, and afterwards 3 degrees. Midway of that portion of the road there was a detached rock, perhaps 75 feet high and 30 feet in diameter, standing in the edge of the water, with a dip of perhaps 10

degrees S. 25 degrees W. The rock there is a shale with coarse pebble rock or rather concretions of sandrock for a thickness of about 20 feet at ten feet above the sea. After that the dip (in a dark gray cliff perhaps 75 feet high) was some 5 degrees southeasterly. Then the bluffs became grassy with only small occasional exposures of rock. The road, however, soon left the shore and passed through light woods over a somewhat broken country, rising to a height of perhaps a couple of hundred feet above the sea, until Chipuran, on the bay of Akkeshi, was reached.

The last hour was travelled in the rain. But after we had lunched at the small Chipuran hotel the weather was better, and while the servants and baggage crossed in a boat (2 ri) to Akkeshi, Mr. Akiyama and I went by boat along the shore seaward (since there was no road for horses) to Beshakodomari (1½ ri), to look at the coal said to be found there. The shore that we passed near had rounded bluffs of one or two hundred feet in height with flat looking tops above, and with thin, light looking forests. Now and then there were cliffs, at first of old alluvial, light-brown and gray sands. But about half-way, at a spot called Shishamonai there were at the water's edge great cliffs, perhaps a hundred feet high, of gray sandrock weathering light-brown, and when covered with lichens looking dark gray, with a dip of perhaps 10 degrees a little south of east. To those high cliffs succeeded a small bay at the mouth of a little valley where the village of Zempoji stands. There was an exposure of gray shales in the bluff just beyond the village; and after that, the bluffs were still a little higher, and there were cliffs of gray sandrock with a dip at first of some 5 degrees easterly and afterward of about 10 degrees S. some 60 degrees W. Several hundred yards beyond that, a cliff of the same gray sandrock showed a dip of some 30 degrees S. some

60 degrees W.; and a few hundred yards further on, small cliffs of gray, slightly greenish sandrock in the bluff showed a dip of only some 3 degrees westerly.

Close beyond that, we found the Beshakodomari coal in some cliffs at the water's edge and in huge blocks of greenish gray sandrock (some 25 feet in diameter) that had fallen from them. One portion of it, said to be about 0.3 feet thick, was concealed by the tide; but it was apparently the same as was seen on the surface of a large fallen block where it had just about that thickness. In the cliff also from which the block had fallen the same layer is seen and measures likewise 0.3 feet but thins out in a few yards to a knife edge. The rock there is a coarse (walnut to fist size) pebble rock like that of Osotsunai with red and green pebbles of jasper. The cliff just there is said to have settled down some years ago, but the dip is still nearly horizontal, say 10 degrees S. 70 degrees W.

A very few hundred yards more brought us to the house at the mouth of the Beshakodomari ravine. We landed again and went up the steep hollow to the right until at the height of 240 feet (by aneroid) above the sea we reached another small so-called coal exposure. The bed was of coal and black slate mixed, and was 2.1 feet thick, close below the top of the ravine and the brow of hill. The dip was 30 degrees S. 35 degrees W. Above the bed was coarse, brown weathered sand rock, exposed to a thickness of about three feet. Below the black bed there seemed to be shales, but they were very poorly exposed.

We had now visited all the exposures of the coal of the Akkeshi coal field, all lying between that town and Shiranuka. One bed at Osotsunai was the only one of them all that had any pretensions to being workable, and even that could probably only be worked in a very small way to supply a local demand. Not only were all the

other beds decidedly unworkable, but most of them were wholly insignificant. They show, to be sure, by their widespread fame in spite of their smallness how thoroughly the country has been searched for coal, and how improbable it is that any other exposure of workable coal has been left undiscovered. It is not likely that any other more workable bed would be left wholly unexposed in so large a space; and it is therefore almost certain that none such exists. All hopes, then, built upon the Akkeshi coal-field, so near to the sea and to a fine harbour, must fall quite to the ground.

In the boat we had rowed so far, but now set out for Akkeshi across the bay with a sail up. A fog soon settled down on the hills so as to prevent any further sketching, even if there had been much more to sketch. In less than an hour and a-half, however, we were passing under bluffs of a couple of hundred feet in height with cliffs perhaps 150 feet high, a little to the seaward of Akkeshi, and were mostly relieved of the fog. The cliffs were of gray sandrock with a dip of some 15 degrees S. about 80 degrees E. at first; but on coming close to the village we found the dip had become perhaps 50 degrees in the same direction. The rocks all seemed to be the same as htose we had left near the coal beds on the other side of the bay.

Finally, at nearly half past six, we reached the hotel of Akkeshi. The village was smaller than we had expected from the fame of its comparative importance and of its excellent harbor; but the place was at least much larger than any we had seen for about two months, and there was even a small number of shops. Half-a-dozen new houses building seemed to show the place was prosperous. The day's journey had been through a region more thinly inhabited than that of the day before and the only dwellings at all were on the sea shore.

The Akkeshi harbor is well protected and is said to have the very best holding ground, mud or clay.

The next day (16 August) was Sunday, and we staid at Akkeshi. I walked about two miles to the ferry at the far end of the town, where a narrow strait joins the bay to a large inner basin or lake. An Aino at the ferry said the water at the ferry was 20 feet deep, but that it was less inside of that. The beach of that part of the bay had a great number of the shells of oysters for which the place is rather celebrated; and one shell, though worn by the waves, measured 0.95 foot in length.

A few score yards back from the shore were hills of two or three hundred feet in height, with a cliff of gray sand rock near the ferry that had a dip of some 40 degrees westerly. About half-way however, from the hotel to the ferry a similar cliff had a dip of some 45 degrees easterly.

The next day (17 August), on our way to Ashirikotan (Hamanaka), twenty-three miles and three-quarters (9½ ri), we passed the last mentioned dip, and went up a small valley to the right of it and over a pass between low hills. The road kept on inland over somewhat uneven ground, perhaps two hundred and fifty feet at most above the sea, through light woods most of the time (at one point a few heavy firs), sometimes merely dwarf oaks, sometimes through open land covered with low bamboo. Now and then the sea came in sight several hundred yards to our right. The first such place was about two ri from Akkeshi; and a cliff, perhaps a hundred and fifty feet high, of dark gray sandrock was to be seen on the shore with a dip of some 15 degrees easterly. A ri further on (against a wayside resting house) there was likewise to be seen a sea cliff of dark-brown weathered pebble rock with a dip of perhaps 30 degrees easterly. Several hundred yards

beyond that, a like dip was again seen in a sea cliff. But opposite the end of the fourth ri there was a cliff of dark brown weathered coarse pebble rock perhaps a hundred feet high with a dip of some 20 degrees westerly. A few hundred yards further on, however, the dip had changed again to some 30 degrees easterly. Near the end of the fifth ri we crossed by a bridge a good-sized stream at a village of near a dozen houses close by the sea shore; and just beyond, there was a cliff perhaps fifty feet high of brown weathered sandrock with a dip nearly level, apparently the bottom of a basin. Several hundred yards more, over a hill, brought us to a still larger stream with a ferry and another village of about ten houses. Just beyond that on the sea shore there was a cliff some fifteen feet high of the same coarse pebble rock we had seen at Osotsunai; and a few hundred yards further on, the same rock in a cliff ten feet high gave a dip of some 5 degrees easterly. Then we climbed the hills again and rode through several hundred yards of much the same country as before, until we finally came down to the sea shore again alongside of a dip of about 5 degrees easterly at the edge of a wide, low plain, a couple of ri from Ashirikotan. The road thenceforth lay along a sandy beach with houses every thirty yards or so the whole way. For in spite of the length of the beach there were rocky islands and headlands near that gave a foothold for seaweed. The islands seemed to be a couple of hundred feet high and were surrounded on all sides by high cliffs of dark-gray rock. One large island (formerly) about midway of the beach road is now connected by a low sandy beach with the main land, and in connection with three or four smaller ones gives some protection to a bay just short of it. At last we reached the hotel of Ashirikotan long before coming to the end of the beach and of the houses. The long beach is called Hamanaka.

The next day (18th August) was rainy and we did not leave Ashirikotan. An illness that seemed slight at first had attacked me the afternoon before; but the day was partly spent in report writing and other office work.

The following day (19th August) Mr. Akiyama and I with some of our attendants rode to Otchishi, twenty-two miles and a half (9 ri), along the coast on the way to Nemoro while the rest, with the chief part of the baggage, took the inland road by Atsuushibets, an easier road it was said, but without the numerous rock exposures to be seen on the sea shore. After starting we rode still half-a-ri along the beach past the continuous village of Japanese houses. Then bluffs began again perhaps 150 feet in height; and there was at the outset a cliff some 100 feet high of light-gray, coarse sand rock and coarse pebble rock with a dip of perhaps 30 degrees westerly. Then for a few hundred yards the bluffs, though steep, were grassy without any cliffs. The road then on approaching a dark-gray cliff left the beach and crossed over a headland perhaps 250 feet high, open land covered with short bamboo, and with light woods some hundreds of yards back. Descending after several hundred yards to the beach again we found a cliff of gray shaly sandrock with a dip of some 15 degrees easterly; but a few yards beyond, another cliff of somewhat shaly light-gray sand rock gave a dip of only 0 to 5 degrees easterly. Then crossing the mouth of a long flat valley with a small village we came to bluffs again and a cliff of brown weathered coarse sandrock with a dip of some 15 degrees easterly. A few score yards beyond, there were cliffs, perhaps seventy-five feet high, of coarse gray sandrock with a dip of some 20 degrees westerly on the side of bluffs a hundred and twenty to a hundred and fifty feet high. Then for a few hundred yards the bluffs were grassy without cliffs, and a broad flat valley of a few

hundred yards in width succeeded. The sea alongside seemed in great part well protected for a wide space, made in fact into a harbor almost, by large islands some distance from the main land.

The road then at the far side of the valley ascended the bluff some two hundred feet high, passing at the foot a cliff of gray sandrock with a dip of some 20 degrees westerly (or southwesterly). Within a few hundred yards the road came down again into a small flat valley close to its mouth in sight of a cliff of brown sandrock on the far side by the sea with a dip of some 20 degrees easterly. The road, however, turned from the shore and pushed inland, passing over hills a couple of hundred feet high, through some thin light woods and some open spots covered with low bamboo and weeds. After a ri or more we came down again to a sea beach at a cliff of gray sandrock, shaly below, with a dip of some 30 degrees easterly. There was a wide flat valley there with half a dozen houses; but after several hundred yards the bluffs along the shore recommenced, though scarcely more than forty feet high at most, chiefly grassy but with some very small cliffs that showed a dip of 45 degrees southeasterly.

At the end of nearly a ri of beach road it was cut off by a cliff some one hundred feet high with an easterly (or perhaps southeasterly) dip. The road climbed over the hills again to a height of a couple of hundred feet, chiefly through open land covered with low (about $2\frac{1}{2}$ feet high-bamboo and weeds, but with brush here and there and thin light woods some hundreds of yards further back) Such a road lasted for several miles with occasional descents into narrow valleys and occasional approaches to the sea, within sight of it, or even passing at one point (perhaps midway) over a stony beach for a few hundred yards. Several hundred yards from the beginning of that upland road we saw cliffs of gray sand rock on

the sea shore with a dip of some 40 degrees easterly. A few hundred yards further on there were cliffs of gray sand rock some 30 feet high with a dip of about 30 degrees easterly (or south-easterly); and just beyond, cliffs of gray sand rock some 60 feet high. Several hundred yards beyond that and beyond the strong beach there were cliffs of gray sand rock perhaps 20 feet high, and a few score yards further on, a small exposure of gray sand rock with a dip of some 20 degrees easterly. A few hundred yards still beyond, there were gray sand rock cliffs some 50 feet high with a dip about level. A few hundred yards more brought us to the mouth of a small valley with cliffs of gray sandrock on both sides towards the sea, from 10 to 30 feet high and with a dip on the near side of some 20 degrees easterly.

At length, several hundred yards beyond that, the road came down to the beach for the last time and kept along it all the rest of the way to Otchishi, a ri and a-half or more. The bluffs continued alongside, with the exception of a couple of small valleys; but were only 50, 40 or 30 feet high, until midway a height of a hundred feet was reached, with a cliff of gray sand rock with a dip of 40 degrees southerly. A few score yards short of that there was a small exposure of gray shaly sand rock with a dip of about 10 degrees westerly. But a few yards beyond there was an exposure of very much contorted beds, probably at the axis of a basin (synclinal). The bluffs then became lower, down to some 70 or even 50 feet, and were grassy all the rest of the way with but one small exposure, at mid distance, of gray sand rock with a dip of some 10 degrees westerly.

Otchishi consisted of but one or two houses and the road for some miles had been very little inhabited. A clean corner of the main building was fenced off for me with screens, and we staid there over night.

Beyond the house a headland ran out seaward with flat-topped bluffs of a hundred feet or more in height, grassy but somewhat cliffy, with a dip of perhaps 10 degrees westerly.

That evening and the next morning (20th August), the slight illness of the last day or two grew worse, so that the strictest fasting was adopted as a cure. But in the morning we rode on to Nemoro 12½ miles, (5 ri). A thick fog for some time limited our view and was rather bewildering

The road at starting crossed the headland within a few hundred yards by a pass hardly 25 feet high. On reaching the sea again, we saw a cliff some 20 feet high of gray slightly greenish shaly sand rock with a dip of about 15 degrees easterly or southerly. We turned our back on that cliff and rode along the beach under bluffs some 40 feet high with exposures of sands and clays that dipped some 40 degrees easterly. At the end of several hundred yards, however, a cliff some 30 feet high with a pulpit rock about 20 feet high forced us to climb over a flat topped headland perhaps 150 feet high, open along the road, but with light woods further back ; but in a few hundred yards we came down again. The road then passed for several hundred more yards along a beach under bluffs of 100 feet or so in height, mostly grasssy, but with an exposure, near the beginning, of dark brown, coarse (fist size) pebble rock without any clear dip ; and at the end a cliff of dark weathered pebbble rock or perhaps sand rock with a dip of some 20 degrees easterly. The road then passed over another headland with features like those of the last, and came in a few hundred yards down to a beach opposite to pretty large, flat-topped, off-lying islands that must give some protection to the sea inside of them. A few hundred yards beyond, there was a succession of exposures a few score yards

apart of dark brown weathered sand rock with south-easterly dip; gray shaly sand rock with a dip of some 5 degrees south-easterly; gray shales with south-easterly dip; gray shales with a dip of some 20 degrees easterly; shales with dip of some 10 degrees easterly; dark gray shales with a dip of some 30 degrees easterly. The bluffs some 60 feet high then drew back from the beach, and left a broad flat valley that contained a dozen houses and reached along the shore to the boundary post of Nemoro district. Near the post there was an exposure of gray coarse sand rock weathering brown with a dip of some 2 degrees easterly. The road at the same point went up over another flat topped headland some 150 feet, high, mostly open land but with some light woods back. But in a few hundred yards we came down to the sea shore again at a cliff of dark weathered gray sandrock with a dip of some 25 degrees easterly. Then several hundred yards along the beach at the side of the low, broad, flat mouth of a valley brought us to a small hill with a cliff at its end, dark weathered gray sandrock with a dip of some 25 degrees easterly. Only a few score yards beyond this, at a small hamlet, we finally left the sea behind and crossed over the narrow eastern peninsula of Yesso, a couple of ri to Nemoro, without seeing any rock exposures on the way. The highest land seemed to be only some two hundred or three hundred feet high, mostly flat or gently sloping, nearly open or covered with scattered light woods.

I had thought of making, while so near, a flying visit to the large outlying islands of Kuneshiri and Etorop, if the steamer *Capron* could conveniently take us on one of its cruises in that direction. She proved, sure enough, to be in port when we arrived at Nemoro, but on going aboard the same afternoon and visiting the sick captain, I learned that she would probably sail within

a few days in another direction. It turned out, too, that we should hardly have had time for even a hasty steam voyage round the islands. There is little doubt, however, that the whole of both of them is volcanic; and we could see one or two beautiful volcanic cones on Kuneshiri just north of Nemoro.

We were, however, informed that the Kaitakushi had sent two of its officers on an expedition of exploration for minerals to Kuneshiri and Etorop after they had spent some time in a similar way on the mainland near Nemoro; we had heard also of another pair of officers engaged in like duty in the Tokachi valley and near Birô. Both parties were sent into the field on business of which I have nominally full charge, but both were sent without the least consultation with me; and no report whatever of the results of their explorations has been given me, beyond mere hearsay accounts at second or third hand. Any special previous consultation may have been thought unnecessary because two or three similar exploring parties were kept in the field last year. In regard to them, however, I was specially consulted in advance within a few days after my arrival in Japan, and told that they were important because the Ainos had so much dislike to reveal the mineral resources of their hunting grounds that it was desirable to send such scouting parties in advance. I was in that way persuaded of the propriety of the measure; but have since found no reason whatever to believe that it was judicious or anything less than the cause of a complete waste of money. No report from any of the parties, beyond a very brief verbal one from two of them in July of last year at Sapf poro, has ever been made even indirectly to me; not even a list of mineral places furnished for the benefit of my subsequent journeys over the same ground; and no authority has ever been given me over those pioneer ex-

plorers so as justify my requiring a report from them. On becoming better acquainted with the Ainos, I have failed to find the slightest disposition to conceal any of the natural mineral treasures that they know about; on the contrary, they seem inclined to give all the little information they have on that subject, though too much unacquainted with the value of the peculiar minerals they have noticed to think them always worth mentioning. The officers in question would seem, with hardly an exception, to have visited only mineral places that were already known for a long time to the Japanese, especially to the local officers and inhabitants, and to have discovered scarcely a single new place. Their examination of the old places has not yet seemed to throw much new light on their mineral value nor on the general geology of the country. If the Kaitakushi has, or can obtain the services of any one man (whether native or foreign) in whom it can place sufficient confidence, I would recommend that all the geological explorations without exception be entrusted to his sole guidance.

The 21st, 22nd, 23rd, 24th, 25th and 26th of August, I was busy copying the long letter to you that gives the detailed account of the trip across the mountains, and Mr. Akiyama was busy most of the time in copying some maps of the neighboring country that we found in the Kaitakushi office at Nemoro. Meanwhile my illness had grown worse, but had finally been starved out, so that eating could at length be safely recommenced after several unsuccessful attempts; the consequent emaciation and weakness, however, were very unusual.

On the 27th of August, however, Mr. Akiyama and I (leaving behind the interpreter who had the night before returned to us from Sapporo) rode from Nemoro to Noshaf, the very easternmost end of the Nemoro peninsula and of Yesso, and back again, 30 miles (12 ri) or more,

in order to see the rocks that might be exposed on either shore. We went by the north-western side and came back by the south-eastern. All the way round, the land rises from the shore, first in a bluff fifteen feet high and then very gently indeed to a height of perhaps 200 feet. The first rocks we saw, even before we reached the outskirts of Nemoro, were brown weathered shales level bedded; but only a few yards beyond was a small cliff of dark crystalline blackish and gray volcanic rock with a dip of some 20 degrees S. about 50 degrees E., and a ledge of the same with a cleavage (or else a dip) that was about vertical. Volcanic rocks, mostly of similar appearance, were exposed beyond that almost continuously along the foot of bluffs at the edge of the water almost all the way to Noshaf, with here and there a little beach at the mouth of a small valley. The dips were: at the end of the small point just outside of Nemoro, about level (?); a few hundred yards beyond that, some 25 degrees southeasterly. The strike seemed generally to be northeasterly all the way. At mid distance or rather more, on a good-sized stream near its mouth was a curious, nearly circular, low, flat piece of ground a few hundred yards in diameter, through which the river wound. All around were bluffs some twenty feet high. The place looked as if it might be the remains of a volcanic crater much worn down.

On the return along the south-east side of the peninsula the same volcanic rocks were seen here and there at many places; but at length at Oshinetsupu (Oshinebets? of Matsura's map) commonly called Honioi for shortness, within two ri of Nemoro, there was a cliff of dark-gray (weathering brown) sandrock with a dip of 15 degrees S. 50 degrees E. It was probably the easternmost limit of the coal rocks that we had found all the way eastward from Shiranuka; for although there are no coal beds east of

Akkeshi, the rocks seem to be of the same group as in the coal field adjoining on the west.

In going round the little peninsula we found the land near the sea bare of trees and covered with low bamboo and grass and weeds; but a few hundred yards back it has light wood. The shore on the northern side has very few houses, mostly deserted, for the moment at least, but on the southern side there were a great many more, in groups of two or three or half a dozen, where there were sand beaches (which are rare on the northern side). The fishery warehouses bore the mark of "Mataju," the same merchant, I take it, whom I have within a few days seen mentioned in a Yokohama news paper as doing business under that name and as having risen from ruin half a dozen years ago to an income last year of seven hundred thousand dollars!

The chief occupation along the shore is gathering the seaweed called kombu (something like our kelp, or quite the same), which is sent in such large quantities to China; and a certain amount of fishing is also done. The kombu grows upon submarine rocks, but for drying it a wide, flat space is needed, and the houses, therefore, are placed along the sandy beaches; and almost every beach however small is occupied. The weed taken with a boat, is spread out in the sun in long strips, 20, 30, even 50 feet long, and at night is gathered into little heaps and covered with matting; every eight strips are tied together at the end and coiled up before putting into the heap. The long narrow leaf of the weed is thick and fleshy, and when chewed is very mucilaginous and has an agreeable taste even when raw; but it is a very important and excellent ingredient in soups, and when simply toasted to complete dryness for a couple of hours before a slow fire is delicious. It is also cooked in other ways. The sea salt in the substance of the leaf or on its

surface gives a very agreeable seasoning; and it has been said that the Chinese prize the weed according to the amount of salt retained upon it. But on the East Coast no care seems to be taken to keep the kombu clean, and it must be washed before use, and thereby some of the salt must be lost. On the shore east of Hakodate last year they seemed to be much more careful about cleanliness while the drying was going on.

When we were at the extreme end of the peninsula we stopped to lunch in the lonely but hospitable light-house of Noshaf; and were struck with great admiration at its neat and well-kept appearance. It is closed every year from the 15th of November to the 15th of April. It belongs to the Public Works Department of Japan and is very creditable to it.

Nemoro itself is but a small place, perhaps 30 or 40 houses and a dozen shops in the main village, rather larger than Akkeshi. The harbor is protected on most sides, but is open towards the north-east from which bad gales sometimes come. By closing with a breakwater a gap of perhaps a quarter of a mile from the main land to the end of a long island parallel with the shore and over against the town the harbor would become an excellent one, though small. Abundant materials for such a break-water are close at hand. The holding ground is said to be poor, only hard sand; but the steamer *Capron* rode out a heavy gale there during our stay at Nemoro.

The country about Nemoro and, indeed, all the way along the coast from Birô, seemed very well fitted for the raising of horses and all kinds of cattle; for there were many wide tracts of open, grassy, pretty level land. Horses indeed, were numerous, grazing at large. At Nemoro were the only neat cattle of the whole region, ten in number, of large size and of a black color spotted with white. As the inhabitants have not yet acquired a taste

for milk, butter or cheese, the cattle are used only as pack animals, and are said to carry one-half as much as horses. They are supposed to eat about the same amount of food as horses, but except for a very few days of the deepest snow in winter no provision is made for any of the animals, and they have to pick up the grass as they can ; in summer they are not fed at all. The climate is very good for cattle raising ; but it would of course be very advisable and in reality economical to provide good hay and grain and the protection of barns and stables. Cold and hunger must at present do great damage to such animals in winter time.

The fatigue of the day's trip (much longer than had been expected) was too great for a very weak state of body and brought back my illness ; but it had again disappeared by the next day (28th August), which was spent in office work, writing letters to yourself and to several of my assistants who needed instructions. The morning of the 29th, was also spent in letter writing ; but about noon we set out on our journey northward, as recounted in the detailed report already given you of that part of our field work.

I have the honor to be,

Sir,

Your most obedient Servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer.

FROM NEMORO BY SOYA AND HAKODATE TO YEDO.

SHIBA, YEDO; 23rd November, 1874.

GENERAL HORACE CAPRON,

Commissioner and Adviser to the Kaitakushi.

SIR,

I have the pleasure of sending you herewith at last my report on the field work from my leaving Nemoro until my return to Yedo.

It is very full in its daily account, because I thought both you and the Kaitakushi could hardly be too minutely informed as to the manner in which my duties were performed. It was wholly planned and mostly written before I had any knowledge that you were thinking of printing it; yet it was all written under the impression that any part of it might by a bare possibility at some day come before the world. It may, however, very well happen that some portions of it may seem to you of too little importance and interest to the public to justify printing them; and in that case I shall be happy to omit, shorten or remodel them.

I beg, however, to say that the very lengthy geological and topographical details, however uninteresting, they may be even to a professional reader, are of just the kind that ought to be printed at Government expense, as they often are by Societies. Though information of so little popular interest could otherwise scarcely get published, it is very useful to place it on record so that it will be accessible to any geologist who in the future may wish to study the region traversed, and his labors thereby will be greatly lessened. Such a record, too, is a perpetual answer to a thousand questions that may arise from time to time in the minds of the different Government officers who may be sent to that part of the empire.

I have the honor to be,

Sir,

Your most obedient servant,

BENJ. SMITH LYMAN.

General Horace Capron,

Commissioner and Adviser to the

Kaitakushi.

Sir,

I have the honour to make you the following rough report of my work, and beg that you will transmit it to the Kaitakushi (for which purpose I send herewith a Japanese translation to accompany it). It has been written in the field from time to time (chiefly as the dates indicate), in order to keep you as promptly posted as possible, and to give the advantage also of writing while the subject is quite fresh; but such a report will naturally be liable to many corrections at the end of the season, and would of course, hardly be fit for immediate publication without revision.

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Although I shall leave out of the report some strictly personal matters that were formerly sometimes put into the letters on account of your friendly interest in me; still I shall not scruple to mention, as before, many things not purely geological. For the Kaitakushi may either find such information valuable on account of its newness, or may at least find both interest and use in looking for a moment at even well-known things through the eyes of a foreigner who has lived long in several other parts of the

world. If I should now and then relate an amusing incident or even make a small joke, I trust that they may not be thought wholly out of place and that they may lighten the task of reading through what might otherwise seem a dreary waste of dryness. If here and there a criticism should be made upon the existing state of any affair, and a change of some kind should be suggested, I hope it will be perceived that it is not done in the slightest degree from any personal ill-feeling, but wholly from a thoroughly sincere desire to be of service to the Kaitakushi (for more than one of whose officers I have a hearty personal respect), of service to the Government in general and above all to Japan, the Sleeping Beauty that the young Prince (America) came to awaken to fresh life and renewed loveliness.

Shibets, 31st August, 1874.—In writing from Nemoro I should have mentioned that large quantities (it is said) of pretty pebbles are found on two islands off the end of the peninsula, the end where the well-kept light house is of which I spoke, called Noshaf. One island is called Suisho (Rock Crystal) Island and is but two ri from Noshaf. We could see it well with our glasses, a low flat-topped island, two or three miles in diameter, without trees. The other island is called Taraku, and lies five ri beyond, and is also larger, perhaps twice the diameter. The pebbles are said to be found on the beach in each island, and not to be found in any solid rock. Some samples were shown me, and they were of the size of a walnut and less; and were all of quartz in one form or another, a few glassy, many agate and many jasper of various colors. Some of the agates were very pretty from having extremely thin parallel, crooked layers of different colors; they would look very well, when cut and polished, in sleeve buttons, shirt studs, brooches and the like. How large a quantity can be obtained cannot be made out very

clearly from the description given ; but a great abundance is very positively declared to be there ; whether that means a thousand good pebbles in a year's searching, or 365,000 it is impossible to judge. I had thought of visiting both islands, but was informed by the Governor of Nemoro that, though it would be easy to go to them, the return might take a week or more. There is a very strong current against the return, and very good winds would be needed. The excursion was therefore given up.

While writing you my last letter on the 28th of August a violent rain storm set in which lasted until the next morning ; so we left Nemoro about noon on the 29th. Before going I went aboard the steamer *Capron* to bid the captain good bye and see if he could take my budget of letters (including the detailed account of the trip across the mountains) to Hakodate ; but it had become uncertain whether he should go there at all or not, as "they were waiting for somebody to arrive from Sapporo." As it would in a few hours be too late for even the steamer to overtake you at Hakodate, the letters went by land. There is not yet any letter-post as far as Nemoro, but they are just now about establishing one, a great step forward.

My Japanese companion was greatly struck by the extreme cleanliness of the ship. I found the captain better in health but still uncertain whether his disease had not become a very serious one, which would require the aid of a skillful surgeon. The captain was almost famished for fresh vegetables having eaten up some I had sent him at first. It seems that his paymaster, having an allowance of sixty dollars a month for the captain's food had laid out the whole of the money of the first month or two in supplies for three months or so, and consequently felt unable to purchase any-

thing whatever until a fresh month should arrive, although he had the money in his hands. The captain was therefore eating last year's potatoes and the like; although there had long been new ones in Nemoro. You can see from this of itself how utterly false is the insinuation of ill natured journalists that there is no honesty nor economy in the Kaitakushi. It was, in fact-but one instance among ten thousand of the strict economy that really prevails in the Kaitakushi and that extends to the minutest details.

The real difficulty no doubt was not ill-will nor stupidity on the part of the paymaster, but ignorance of the best modern methods of keeping accounts, which seem generally to be little known in Japan. For instance, the merchants here call their book of original entry their "water book," because when its items have been copied into the ledger it is washed clean again; a plan that necessarily takes away all possibility of tracing with any certainty the facts in regard to any outlay or receipt of money, and opens the door to a thousand errors and frauds. The introduction of modern book-keeping has long seemed to me to be a matter of the very greatest importance not only to the mercantile community of Japan but to every branch of the Government; for not only would it make fraud in the outlay of the large sums of Government money almost impossible, but it would render possible at all times the removal of any doubts as to the course such money has taken.

We came in the afternoon about 21 miles ($8\frac{1}{2}$ ri) to Atsuushibets, on the shore of a lake half a mile or more in width (of which a lovely view is cut off from the honjin by a most unnecessary fence); and there I hoped to pass a quiet Sunday. But the honjin was not overclean and so infested with swarms of mosquitoes as to be intolerable. After having been kept in torment (even

with an imperfect mosquito net) from the end of my first sleep, perhaps two o'clock, until about four, I rose at the beginning of the dawn, and rested better while walking in the yard until about five. Then an early breakfast was given me, and the ferryboat was got ready, and I was off before six on my way to Bekkai, on the sea shore, two ri distant, where I arrived a little after 7 o'clock, and where we spent the rest of the day, although there were some mosquitoes there and the honjin was not the very best.

Indeed ever since we reached Akkeshi we have greatly missed the beautifully neat honjins and extremely polite treatment that we had found almost everywhere on the way from Birō; until to-day there seems again a little improvement here. Why one whole province should differ so from another is hard to understand. The reason is perhaps that the province of Nemoro is more populous and the honjins are therefore more frequented and become dirtier. That reason would however hardly apply to the room given me at Akkeshi, for the landlord was at first unwilling to give it because it was reserved for the Hangan (the only one of that rank, I believe, is the Governor of Hakodate)! and his visits cannot be very frequent. The landlord thought the room, poor as it was, too good for an American geologist who had at head-quarters been reckoned so much more important to the Kaitakushi than even a Hangan; but perhaps he judged the stone by its setting, not knowing its cost.

The simple hotel-keeper's harmless contempt for me as a foreigner (so I took it to be) is hardly to be wondered at when even the Government treats its foreign servants in some important respects (quite unlike the custom under other Governments, the English, for example) as inferiors I do not say of Japanese officials with like salary, but even of the lowest native official, however,

young and ignorant; a treatment that seems to me like a leaden setting to a costly gem. I mention the matter because it seems to me to be one of the highest importance to the Kaitakushi and to the government generally; for it is one of the chief reasons why Japan finds it so difficult to obtain even at great expense satisfactory foreign servants, and having after trial sometimes found them, so much more difficult, even, to keep them.

The repose of nearly a whole day at Bekkai was most welcome, and was needed almost wholly for bodily rest alone; for in spite of my illness at Nemoro there had been, including Sunday, but one whole day lost from work in all; and before that days of rest were quite rare.

This morning we came 20 miles (8 ri) to this place, still on the sea shore, and our road was a great part of the way close to the sea; as it has been all the way from Nemoro, except the last half of the way from Nemoro to Atsuushibets. The country all the way from Nemoro has been very low, often for large spaces quite flat (especially from Atsuushibets to Bekkai); but commonly with a low bluff near the sea shore rising to a height of fifty feet or so and with nearly flat land at the top, but of course somewhat rolling here and there because of streams. The shore is mostly sandy, seldom pebbly, and the bluff covered with grass; and since leaving Nemoro, has been quite free of any rock exposures, and seems to be chiefly made up of alluvial matter, which is sometimes exposed. Further back from the shore the ground seldom seems to rise to a height of more than 75 or 100 feet; but the eye may be deceived, the slope is so gentle. Near the shore there are commonly no trees, but some 300 yards back small ones begin and further back grow larger and larger, but seem even in the end to be light; and this morning they were also very thinly scattered. They are mostly hard wood trees, but the other side of Atsuu-

shibets there were a good many firs, though no heavy ones.

Chiraiwatara ; 1st September.—This morning we came here from Shibets 18¾ miles (7½ ri), no longer along the sea-shore but directly inland, and instead of northerly somewhat south of west. For there is, a dozen miles north of Shibets, a peninsula that juts out north-eastward some forty miles into the sea and is covered with high mountains across which there is no road, nor around them on the shore either. The road instead goes by a long circuit inland three days' journey from shore to shore through a comparatively level country. It seems that thirty years or so ago there were several such roads across this end of the island, and we heard of one near Kushiro, that at the north end comes out out near Shari (the place our present road leads to) and that is still to be traced and, all but seven ri in the middle, is still passable for horses, and the old ri posts and ruined honjins are still to be seen. They say that in those times this part of the island was much more thickly inhabited than now and very prosperous ; men travelled in kangos and were men of leisure, after 300 years of peace. But wars came in Japan, and the troubles that followed the coming of foreigners, and gradually the settlements here fell into decay. I had some thoughts of crossing the island by that road, 41 ri, and back again ; but on counting up at Nemoro the number of days still at our disposal we found that we could not safely expect leisure for that trip of twelve or fifteen days in this stormy season. There was nothing of special interest to be seen on the road, so far as known, except a hot spring and some volcanic sulphur that was once worked and was abandoned ; and therefore was probably scarcely workable, to say nothing of the well-known fact that such deposits are in all countries very small, as we found them at several places last

fall. The road was said to pass by a large lake. In going over the road I should have hoped to see something of the rocks here and there, but perhaps should have seen nearly as few as on this road; that is, so far none at all. The existence of such roads and of a Japanese population formerly in the interior, shows how very unlikely it is that any deposit of valuable minerals there should have escaped notice.

On the shore northwards of Shibets, two ri distant at the foot of a bluff close to the sea, Mr. Hirano and his Japanese companion last year are said, with the help of two Ainos, to have washed for gold and in half a day to have found altogether ten very minute grains, or an average of five such grains a day to each man. The result was so poor as hardly to justify our going out of the way to take a look at the place, much less to stop and wash a large measured quantity of the gravel.

Still further north and a ri and a half from the sea-shore, at a distance of twenty eight miles and three quarters (11½ ri) from Shibets, of which more than half is impassable for horses and therefore must be travelled a-foot, are some hot springs; quite small according to the description, a number of slender threads of water issuing from the ground within a space some fifteen yards long; but very hot and having a slight smell of sulphuretted hydrogen and a small deposit of white sulphur along the edge of the water.

Beyond the hot springs it is impossible, they say, to go even on foot along the shore to the end of the peninsula; and by boat the current is so strong that it sometimes takes eight days to make the trip. It was then out of the question for us to go that way to see the rocks, which must therefore be studied, if necessary, on the other side of the peninsula. The sea is said to have been sounded on this side to a depth of a thousand feet.

Along the sea shore this side of Nemoro there is no gathering of sea-weed owing to the absence of rocks for the weed to grow on; but there is a little herring and salmon-fishing.

The road we came over to-day was on the whole nearly level, though passing at times over heights of fifty feet, or say a hundred or more above the sea, and in the main following up the valley of one river, the Shibets, which was, however, commonly far out of sight. The slopes were generally very gentle, but near this end of the road there were bluffs of fifty feet or so in height with nearly flat land both above and below. The woods were almost everywhere very light, commonly mere brush, and commonly very thin also, with several pretty large open spots. The largest one was a mile-and-a-quarter (one-half ri) or so long and perhaps a quarter of a mile (one-tenth of a ri) wide, containing therefore a couple of hundred acres. It was covered with short grass and weeds and bamboo. The ground everywhere in fact to-day was covered with low bamboo, commonly very thick. The road was the narrowest possible horse-path, in many places nearly overgrown, in others lately repaired, as if passers by had been expected.

It is said, however, that there are commonly hardly three men passing over the road in a year; and we passed but one dwelling on the way, and that not very far from the sea. It seems almost a wonder then that the road should be kept in repair at all and the honjins kept in use, especially when you consider that those are not kept up by the government. There are in fact no honjins properly so called in Yesso, they all a few years ago passed into private hands and are merely hotels, a system that seems to work admirably well. Here, for example, although the house is small and old it seems to be well attended, and the most polite and hospitable welcome was

given to us travellers; although the fixed price agreed upon at the outset of the private management of the old honjins, thirty cents a day for each traveller, whether lodged in the best room or in the kitchen, even with the customary addition of a voluntary payment for the tea by the occupants of the best rooms, is far too little to repay the expense of keeping up the house all the year round, and though the landlord himself is paid a salary and has no interest in the travellers' fees, and therefore in his heart must wish them in Jericho. Perhaps there is on the part of the Government (unknown to me) some means of control over the mode in which the old honjins are kept; for otherwise one would suppose the owners' lack of interest in the matter would lead to their decay.

In this region the old honjins are in the hands of a Hakodate merchant, named Fujino, who does all the fishing and seaweed gathering this side of a point beyond Nemoro. At all the villages and hamlets his wooden warehouses are conspicuous, marked on the door with two characters that read "Mataju," by which he seems generally to be known as by a name, though it is but a sign chosen by him. On other parts of the coast the warehouses all have some other sign marked on them; some times one merchant has but one small establishment. The class of such merchants is called by the same name as is used for any government contractor, but would seem in their case to be better translated by lessee. They agree with the government to pay it a certain percentage of the fish or seaweed they take, a percentage (or excise tax), that varies from about five and a half to thirty per cent, according to the merits of the place taken, and averaging perhaps ten per cent. The arrangement seems to be just like that of leasing a coal mine. Although they seem practically to have exclusive privileges for each

place, yet it is not so far a monopoly as to prevent other merchants from coming also, if they choose, and making a like agreement with the government; though a certain length of the shore is at the same time leased exclusively to each man. The lease is given to the first comer without any extra payment for the privilege. The plan seems very much to facilitate the collection of the revenue, and perhaps increases its amount by placing the business in the hands of capitalists who can carry it on in a large way. Mataju's business seems to be prosperous, and new buildings are going up for him at several places, particularly at Shibets.

These lessees, besides employing the immigrant and native Japanese and Ainos, bring yearly great numbers of men from Nambu for the fishing season, Mataju for example has one or two thousand. On all the shores of Yesso perhaps tens of thousands come from Nambu every year and return for a few months to their but slightly warmer, yet native and therefore more warmly-loved region. As the herring fishery begins early they set out from home in January and are perhaps a couple of months on their way to the more distant points. They make journeys in junks that carry perhaps fifty men each, and that are fitted out with the very best of rigging. Yet owing to the storminess of the season and the fewness of harbors, there are sometimes in a single year hundreds of lives lost by the wrecking of such ships.

These facts suggest two very important considerations for the Kaitakushi. In the first place a system of telegraphic weather reports throughout Japan, connected also with the one lately begun or soon to begin in China, would enable the weather on the coast of Yesso to be predicted commonly a day or two in advance, and storm signals could be set up at different points along the

coast in the same manner as has been done for some years in Great Britain and in America. The sailing vessels then would be able to creep along with some safety from one of the few harbors to another, and at the approach of a storm could lie by until it was past. The plan also in connection with the similar work done in foreign countries would doubtless help forward very much the science of meteorology, and perhaps lead to the possibility of predicting stormy weather still longer in advance.

The other consideration is that a system of roads through the main valleys, such as I suggested last winter, would enable this large body of travellers to pass safely and cheaply to their places of work. An inexpensive road, for example, through the Ishcari valley, connecting at Sapporo with roads to Hakodate and Matsmai and at the upper part of the valley with roads across the low passes, by the Sorachi to the Tokachi, by the Aibets or the Rubeshibe to Mombets, by the Uriu to Rurumoppe, and so to the other chief points on the coast, would not only open up the island to immigrant settlers, but would render the fishery and sea-weed business much more easy and profitable; and, far more important than all, would save yearly hundreds of lives. The fishermen instead of being carried in vessels at great risk and expense and a delay of sixty days would carry themselves on foot in, say, twenty days at the expense, besides their wages, of only their food and lodging. The saving to the fishery business alone would well repay the cost of such roads; but, besides, their importance in opening up the fertile parts of the island to settlement would be extremely great. Besides the necessary hotels that would spring up along the roads there would no doubt be many a farm established to supply such points with food, and of the thousands of men yearly passing twice over the roads many would find places for a home

quite as attractive as their beloved Nambu. Moreover, according to the plan I suggested last winter of paying partly in land at a low price for the labour of making the roads, their cost would *not* only be reduced to a very small sum, but a considerable population might be at once secured. It is perhaps needless to say that in order to made the scheme profitable the roads, though wide enough to be passable for wagons and thoroughly well graded and skillfully laid out should be at first much less pretentious than the still more important New Road from Hakodate to Sapporo, and should be built with far greater economy than that is reputed to have been built with.

Shari; 11th September, 1874.—It might perhaps be feared by some that the practical monopoly of the chief business of whole portions of the coast by single lessees, who are as it were daimios within their own dominions, having the whole population, men, women and children dependent on them in health and in sickness, might have an unfavorable influence upon the opening up and settling of the island by crushing out individual enterprise and by lessening the profits of the original laborer. It is probable that the lessee, although he cares well for his dependents and looks out for their interest to a certain extent, yet looks out still better for his own interest; that is human nature even among the Japanese. Still, so far as a traveller through the country can perceive there is no disposition to complain on the part of the inhabitants nor any apparent ground for it; the lessee seems to be a very good daimio for them at present. They are almost wholly not only very poor but very ignorant, and, if they undertook to sell the products of their labor directly to passing merchants or indirectly to distant consumers, would probably receive still less for their labor than at present; and the greater expenses of the "middle men" would hardly justify better prices. The

fact that so many laborers are brought yearly from a great distance would seem to preclude on the part of the lessee all opposition to immigration for a long time to come at least; since the presence of more immigrant fishermen would make the cost of their kind of labor less; and if farmers came, the cost of food and consequently that of labor also would be diminished. The plan of leasing the coast therefore seems at present to have no serious objections; but perhaps to require watchfulness on the part of the Government to prevent oppression at any future time when a change of circumstances may bring temptation and opportunity of that kind to the monopolists. For example, as the payments for labor are probably made chiefly or wholly in rice, cotton, cloth, wine or other articles brought from a distance, a tendency to reckon them at too high a rate, that is, in effect to lower too much the wages, would not only discourage, immigration but make those already here wish to remove. Perhaps even the fear of falling, in respect to wages, wholly into the power of one man, not held strictly responsibe nor carefully watched by the government would of itself greatly deter immigration; for in the case of such widely extended leases removal from one man's district to another would be difficult and the fewness of the lessees would enable them to combine against the laborer. The system might also perhaps become the source of much serious harm to the public in the way of giving valuable leases to favorites merely (who in return should with their wealth strengthen the power of their favorers) instead of to the most suitable men or with strict impartiality, in case the management of the Kaitakushi should ever fall into the hands of men not strictly upright; but complete freedom of public inquiry into the facts and of public criticism on them ought to be enough to prevent such abuses on the part of government officials.

As to the collection of the revenue from the fisheries a very gratifying impression of honesty is produced by the exact knowledge of the yearly produce of each place that seems to exist everywhere, and the total absence of any effort to conceal it. Indeed the freedom with which all kinds of statistical information in regard to the staple products and to the population is given to me forms a most agreeable contrast to the childishly unwise attempts to conceal every thing of that kind that were formerly imputed to the Japanese by travellers, some of whom even mentioned that when they passed through a village the houses were all carefully closed beforehand by express order. I must confess that I have never seen even a trace of such a desire of concealment in travelling in Japan (though in the native villages of India there is a very marked unwillingness to have foreigners pass through the streets even); and I cannot but wonder whether those early travellers were not sometimes mistaken in their opinions as to what they saw and heard. As for hearing they were very dependent on interpreters, and a lack of full explanations in answer to every inquiry might have arisen very often either from the interpreter's love of his own ease or want of interest in the subject or from his inability owing to imperfect knowledge of the foreigner's language to make everything clear, at least without very great (and perhaps in his own opinion useless) effort. Even a wholly imperfect acquaintance with the Japanese language is a very great help towards gaining a knowledge of facts here; for it removes the need of boring one's interpreter always with every inquiry. Such easier intercourse clearly tends greatly to remove the possibility of many a misunderstanding, and consequently of many innocent misrepresentations of the country abroad.

In fact the very many and various advantages to the Japanese Government of facilitating communication be-

tween its foreign servants and the Japanese are so great and obvious, that in my opinion it would be well worth while to offer such servants special rewards for proficiency in the language, as the British Government does to its officials who learn the native languages of India and other allied Asiatic languages ; and I have therefore thought proper to bring the matter to the notice of the Kaitakushi by mentioning it here.

The precision with which the population, or at least the number of houses, is everywhere freely given seems to show such exact knowledge on the subject as strongly to confirm the published official census returns which could so easily be made up from adding together the different places. I am therefore almost forced to give up altogether the idea I had last year of there being in reality a much larger population, judging from the southern portion of the island alone. The yearly importation of such large numbers of Nambu laborers must also necessarily give in the summer the appearance of a much larger population than the actually permanent, counted one. Long stretches too of the more northern coast, as from Birô to Kusuri (same as Kushiro) and from Nemoro northward are comparatively poor in population, because the absence of harbors and of rocks covered with seaweed furnish less opportunity for productive labor.

As the statistics we have picked up may not be conveniently accessible to you in such detail or more exactly elsewhere, and may be of interest while you travel as it were over the ground with us, I give here a table of them up to the present time.

PLACES.	JAPANESE.				AINO.		AVERAGE YEARLY PRODUCTS, IN KOKU (ROUGHLY).				LESSEE AND REMARKS.
	Houses.		Souls.		H'ses.	Souls.					
	Native.	Immigr.	Native.	Immigr.			Kombu.	Herring Manure.	Masu.	Salmon.	
Biro		3			45		8 000	300	—	—	
Berufune		1									
Ohotsunai		1			2						
Shakubets		1					—	—	—	300	800 deer hides also.
Shiranuka		2		11	84	350	—	—	—	180	
Kusuri		135		528	128	581	20,000	1,000	—	500	
Kusuri Upper River		—		—	38	200					
Akashi		—		—	18	74					
Ashoro		—		—	15	93					
Kombumori		32			2		5,000	—	—	—	
Akkeshi	38	219			90		6,500	—	—	600	Mitsui (Yedo).
Hamanaka	42	—		—	—	—	2,000	9,000	—	150	Ditto, Small herrings only (konishin).
Otchishi	—	1	—		—	—	3	—	—	—	Sudzuki Shobe (Hakodate).
Nemoro	70	23			13		3,000	8,500	300	3,500	"Mataju," Fujino, (Hakodate).
Atsuushibets	—	1		140	—	—	—	200	100	350	Ditto.
Shibets	—	1		165	19	98	—	1.000	300	3,000	Do.
Bekkai	26	—	60†	—	42	140	—	1.500	200	500	Do.

Tokoro, 14th September.—The average market value of 100 koku of common kombu is perhaps about 400 rio; but a special kind, taken on the northern part of the west coast, from Rurumoppe to Soya and on the small islands opposite, and highly prized at Osaka but not sent to China, is sold at some 700 rio. The average market value of 100 koku of salmon taken in the sea is perhaps about 1,000 rio; those taken in the Ishcari River are less esteemed, have poorer flesh and a hooked nose, and are eaten at Yedo only by laborers and the poor. Sometimes 100 koku or 6,000 salmon are taken at a single haul; or even by adding to the net four sacks a good many more are taken at once. The average market value of 100 koku of masu (salmon trout?) is perhaps about 500 rio. That of 100 koku of herring manure perhaps about 700 rio.

Without knowing for each place the number of transient laborers employed and the excise paid it is impossible to calculate from the table the gross return in money for each laborer, and so to form a more precise idea of the prosperity of the business. Still, it is clear that the return is very large in proportion to the fixed population; and it seems highly probable that the net profits are on the whole very ample. The privilege of holding a lease then must be something valuable; and in consideration of that and of the fact that the public runs great risk of abuses in the case of monopolies, it seems but fair that certain special safe-guards should be exacted wherever existing agreements or the making of future leases may permit. Would it not be just to stipulate that the lessees on the one hand should pay their laborers at a certain reasonable money rate, higher of course than the average rate in the milder climate of Nippon, but perhaps having a certain ratio to that (say half as much again) and revised with reference to it by the Government from time to time? At the same time that the lessees on the other hand either should

sell nothing at all to their laborers, leaving such trade to the competition of other merchants; or, still better, that they should furnish their laborers with supplies and goods of all kinds at say the Yedo retail price (perhaps not, however, for exportation to Nambu?) Is it not likely that the anxiety of the laborers to return every year to Nambu arises in great part from hopes of finding there the yearly expenses of themselves and of their families much less than they would be in Yesso; and under the proposed arrangement would they not probably find Yesso as attractive as Nambu, since the difference in climate is so trifling, and they could here live with their family the whole year round? Perhaps they already believe in the French proverb that a man's own country is where he is well off ("ou on est bien, là est sa patrie"). On the other side, by the flowing in of permanent immigrants the expense of transporting yearly so large an army of laborers forth and back, would be removed, and the expense of the fisheries would probably be in reality far more diminished thereby than would make up for the cost of transporting the necessary supplies from Yedo, to say nothing of the difference between the wholesale and retail prices there, which would go to the profit of the lessees. The cost of such transportation, too, would be comparatively light, because it would be done by the same vessels which otherwise would come empty for the products of the fisheries. Moreover the money rate of wages would probably be much lower than it is now though giving better satisfaction to the laborer on account of the cheapness of goods. The advantage of the arrangement would not come from lessening the lessee's profits in behalf of the laborers, but chiefly from substituting for the uncertain, selfish course of unstable, irresponsible individuals the settled, impartial policy of a stable overwatching Government on whose protection

both parties could rely, and both would gain by the change.

A matter of such vital importance to the Kaitakushi, involving as it does not only almost the whole of the present business and revenue of the island but in a very great degree the prospect of future immigration and settlement, cannot be too thoroughly discussed nor too carefully considered; and that has been my reason for entering into it here at some length. Many of the considerations will apply equally to the leasing of coal mines.

On the second of September we rode from Chiraiwatara to Wakkaoi, called nine ri and a half or 23¾ miles. Some eight of those ri were in a general west-north-westerly direction rising very gradually from some 200 feet above the sea to some 1,600 feet, and were still in the valley of the Shibets river though far from the main stream; the first six ri or so over nearly flat ground and mostly through open prairies covered with low grass and low bamboo and weeds, surrounded by brush and thin light woods, with sometimes a low bank of ten feet or so on the right to a river bottom and on the left a hill of fifty or a hundred feet; the other two ri through likewise open ground with thin light woods here and there, but somewhat more broken and hilly with the road chiefly in a narrow shallow valley. The last ri and a half or so before coming to Wakkaoi were in a northerly direction through light fir woods with thick low bamboo, rapidly descending a narrow valley with high steep banks or hills on either side to the solitary honjin some four hundred feet below the highest point on the road and some 1,200 feet above the sea. About half-way between the two honjins high hills and mountains were to be seen a short distance off on the right and northward. No rocks were to be seen anywhere on the road. The heights just given, however, though suggesting some idea of the reality,

are very little to be depended on, as our barometer readings disagree so much among themselves as to show that some of them or all were very much out of order.

The road was in many places very much grown over on account of the rarity of passers ; and the whole way there was not a dwelling to be seen. About midway there was an empty resting shed, such as we have met with here and there all the way from Birô.

Mombets, 17th September.—A mile or so (half a ri) short of that resting shed we turned aside to visit some hot-springs about four miles (1½ ri) off to the right (northerly) ; but afterwards came back to nearly the same point on the main road. The springs were at two places ; the nearest, on the Paushibets branch of the Shibets ; the other half a mile (7 chô) or so northeast of that on the Shibets itself ; both places are at the same height above the sea, perhaps 900 feet. In order to reach them we rode through an open country as before, but a much more uneven one, passing around the foot of some high hills over against the before-mentioned resting shed, and crossing one or two small brooks in deep hollows ; again rising near the springs to high ground from which we had views of the sea across a flat looking or very gently uniformly-sloping, wooded country to the sea some 25 miles (10 ri) distant in an east-north-easterly direction, near the mouth of the Shibets ; and at last descending a very steep hillside, perhaps 80 feet high to the Shibets springs, having climbed up a like hill on leaving the Paushibets.

The Paushibets springs are some twenty yards easterly from the main stream (a small brook running here southerly) in a small parallel branch water course of their own at the foot of the hill just mentioned ; on the other side of the brook the slope is more gentle. They are all within a space of about 31 yards long by five wide, and are very

numerous if you count separately all the small threads of water that issue from the ground, but three of them are larger than all the rest put together. The largest discharges perhaps three-tenths of a cubic foot in a second; the next largest perhaps two-tenths; the rest all together perhaps five-tenths; making in all a discharge of perhaps one cubic foot (say eight gallons) a second, quite a small affair; yet it would be enough to supply a small bathing establishment, especially as the water is quite hot and would therefore bear mixing with cold water. The temperature at the main spring was 81½ degrees centigrade; at the next largest 75 degrees C., but here on account of shallowness the mercury could not be plunged fully into the water. The water does not tarnish silver, and so contains no sulphuretted hydrogen, and the only smell is a merely steamy one. There are many bubbles rising with the larger streams of water at their first issuing from the ground, probably bubbles of carbonic acid gas. The water leaves a slight deposit of red iron rust, but chiefly an abundant white incrustation which is perhaps mainly silica. The spring rises from a dark-gray coarse sand or fine gravel, but at one point the stream from one flows for a very little space over a gray rock. No doubt they all issue very directly from the same dark-gray trachytic rock that is exposed at the Shibets springs.

Sawaki, 18th September.—The Shibets hot-springs are at the foot of the steep hill already mentioned, on the west side of a small branch stream flowing southerly into the Shibets, which is within about a hundred and fifty yards of distance from the furthest spring, and has here a general southwesterly course; the land on the other side is nearly flat. The principal springs are five or six in number, besides a large number of smaller threads of water; and the discharge in all is perhaps a dozen gallons (1½ cubic feet) a second. The lowermost spring

is some fifteen feet up the hillside close by the Shibets itself, and yields but little, say 0.05 cubic feet a second. It issues from the soil close by some imperfectly exposed rock, undoubtedly the same as that seen better at the other springs and at a small cliff a few yards below on the river bank, a gray (weathering light-gray and buff) trachytic tufa pebble rock, with a dip of some 20 degrees N. 70 degrees W. at the cliff. A thermometer that was only partially covered with the shallow water marked 70½ degrees C. Other, cold water trickling down the hill side mingles with the hot, and both fill a bathing place hollowed out of the ground near the foot of the hill. The water is no doubt of the same character as that of the other springs. The nearest of them is about a hundred yards northward, and they all lie in one group within a space of fifty yards long north and south and, say, ten yards wide. The lowermost of them yields perhaps two-tenths of a cubic foot a second; seems to issue from the soil at the foot of the hill; has a temperature of 82 degrees C., and like the others has a slight red deposit and a white incrustation like that of the Paushibets Springs. No doubt the water at all the springs is of the same character. The next upper spring is some ten feet higher in level; has a discharge of perhaps two-tenths of a cubic foot a second; issues from a small hole in the solid gray (bright green when freshly broken) trachytic tufa pebble rock, which just here contains some white iron pyrites (marcassite), and close by some specks of obsidian; and the temperature was 82 degrees C. with the thermometer but partially under water. Next is the largest spring of all with a discharge of perhaps three-tenths of a cubic foot a second, reinforced within a yard or so by a small spring of one-tenth of a cubic foot a second; both issue in like manner as the last from holes in the same rock; and the

temperature at the main spring is 6½ degrees C. The rock is pretty well exposed a couple of yards above on the hillside, and has a dip of 30 degrees N. 50 degrees W. It is the same gray trachytic tufa pebble rock (the pebbles of nut size) with a few small specks of obsidian. A few yards still further north is the uppermost spring, a small one, of perhaps five-hundredths of a cubic foot a second, issuing from the mud. The two or three largest springs seem to have formed a large mound of white concretionary rock on the hillside below them. Below that there are a number of holes dug in the ground to serve as bathing tubs, and are used by the Aino and Japanese frequenters of the place. One Japanese from Nemoro was at the time of our visit living solitarily here, so many leagues from any village, in the single hut that is built on the flat ground close by. The Ainos had stuck many whittling sticks about the springs, as they are wont to do at places where some specially mysterious or superior power seems to be manifested.

Sawaki; 20 Sept.—I arrived at the Wakkaoi hotel that night about six, and the last of the baggage about the same time; and my companions three-quarters of an hour later. One of the servants related that on the way he had seen a large bear only twenty yards off at one side of the road, and that it did not run away. "But did you run away?"—"Yes, indeed!" Perhaps he did not wait long enough to see whether the bear ran away or not. Probably it would have done so judging from an observation of my own. One or two ri before our first arrival at Nemoro, while riding in a narrow crooked path, I suddenly at a turn of the road met a good sized bear that was plodding along towards me with his head down, hardly ten yards distant. The horse instantly stopped, the bear looked up, saw us and immediately wheeled about and ran away. I tried to chase after him, but the horse could

be urged only a few steps forward before he stopped. He had apparently seen bears before or heard of them; or perhaps he had never even heard of them, for he showed much the same signs of fear when he first saw bullocks at Nemoro. The presence of bears and wolves in the mountains (though far less numerous than the deer) will perhaps be some hindrance to the introduction of sheep and even larger cattle; and perhaps it will be thought necessary to encourage still further their extermination by offering bounties, as is done in other countries. The Ainos make a trap for them; and on the Otopchi we saw a dozen large bows hanging on a tree that were for use in a bear trap which should shoot a volley of arrows in different directions, so as to make more sure of hitting.

The deer seem to be still quite abundant in the eastern end of the island, though less so than formerly, they say, and apparently less so than on the Ishcari waters. As we turned off the main road to go to the Shibets hot-springs we started up four or five deer that ran before us over the grassy plain.

Another interesting wild animal is a very large eagle that we saw about Nemoro, measuring some five feet from tip to tip of wings. It would let us ride very close to it on the beach, and then would fly off a short distance with its huge flabby wings. We saw many eagles of a smaller kind during our Ishcari trip as well as afterwards on the sea shore. In former times the gathering of eagles' feathers was quite a business in Eastern Yesso, it is said, and they were sold in Nippon at a high price to be used for winging arrows.

The large Nemoro eagle would be a magnificent object in our Museum and a pair ought by all means to be secured and well stuffed. It is highly desirable also in the interests of science that good and amply numerous speci-

mens of all the wild animals of Yesso, both their skins and their bones, should be taken soon and carefully preserved in that and other Museums; for as the settlement of the island advances some of the kinds will probably become extinct at no very distant day. Such specimens are so useful for scientific studies that any duplicates not wanted here could readily be exchanged in Europe and America for other similar objects, with which the Japanese Museums could therefore be enriched at comparatively small cost.

Shônai; 22nd September.—The weather had been threatening and a little rain had fallen the day of our visit to the springs; but the next morning (3rd September) it rained heavily, and continued to do so with some interruptions through the day. We therefore stayed at Wakkaoi and occupied ourselves with office work; the copying and translation of this report was begun. The next morning (4th September) we had rain again, and had begun to continue the work, when at half-past eight we learned that there was a better prospect, and within an hour we had packed up and started for Shari on the sea shore, 25½ miles (10,2 ri) distant. They said that Wakkaoi, so high up in the mountains, was a very rainy place, much more so even than a point only a couple of ri distant on our road, and that it was commonly as cloudy and threatening as when we left it; so we were glad to get away from the charmed spot in a comparatively good moment. In fact on our way it did not rain enough to speak of, and before we reached Shari it was quite fair.

The road at first kept on down the narrow valley of the day before; but at the end of a ri and a half or so, the valley had become very wide with low (ten to twenty feet high) flat-topped hills or upland, slightly-rolling ground, over which the road passed quite distant from

the brook. Several times however we came to its banks, and by noon found it a stream of perhaps a hundred cubic feet of discharge in a second. On its banks about one o'clock I reached the ruins of a resting shed about half way which had been fitted up for our passing with canvas walls and was attended by two or three Japanese and Ainos, and it was very convenient for the others, but for my part I hurried on to Shari in some expectation of rain and in hopes of getting there in time for a long rest. We passed the fallen ruins of two or three other resting sheds in the course of the day, but not a single dwelling short of Shari. From the half-way place the rest of the way to the sea shore was very level in appearance though gently descending; and the last third of it was somewhat swampy, and the road was for long distances made with split logs laid lengthwise, very slippery and fatiguing for the horse and requiring a very slow, careful gait. At length the sea was reached with its sand hills near the shore; and in a couple of miles more to the eastward I came at 4 o'clock (the rest at five and six) to the little village of Shari and crossed a ferry. The hotel had blue and white broad striped canvas hung round the fence in our honor, and we were received with the greatest ceremony and politeness, quite in the fashion of the olden time; for extremely few travellers pass along this coast, and it is therefore yet comparatively uncontaminated in respect to manners by the effect of the entrance of the foreigners into Japan.

We had hardly been five minutes on our way in the morning when we met with a small rock exposure; it seemed to be a trachytic tufa pebble rock, and contained pebbles of pumice among others; the dip was perhaps about level. Within a couple of miles we found another like exposure of like rock by the road side. Those were the only rocks we met with anywhere on the main road from Shibets to Shari.

The first quarter of the way the timber was chiefly fir and light, then gradually the firs disappeared and the hardwood grew heavier ; and about one-half of the whole distance to the sea, on the nearly level space, the timber was quite thick, heavy and fine. Then it grew lighter and thinner in the swampy ground ; and at last it became merely brush with a border of few hundred yards quite open along the sea shore.

The next morning (5 Sept.) we set out by boat for a visit to the Itashibeoni sulphur mines, a dozen ri or thirty miles, to the eastward, aside from our main course, on the north side of the peninsula already mentioned as lying to the northeast of Shibets. As there was already enough of this report written to give several days' work of translating and there was little prospect of leisure for it on our trip to the sulphur and none whatever of any other need for the interpreter's services, I of course left him behind at Shari, saving thereby the wholly useless labor and expense of his going with us. On such a journey any addition to the party is an encumbrance that must be compensated by some special usefulness ; and in this case it turned out for all concerned particularly fortunate, in the matter of carriage, that our number was no greater. Although we also left most of our baggage at Shari, we afterwards found that we would better have left still more ; but we thought a trifle more or less in the boat would make no difference, while it might add very much to our convenience.

We and our luggage and food in that way were reduced enough in compass to go all in one boat ; but that was a rather large one (40 koku, say 6½ tons) in order the letter to ride out the waves in case of heavy weather. It was manned by two Japanese boatmen and ten Ainos, three of them young women, for in these parts the Aino women seem to work in

just the same way as the men. Nine of the Ainos each with one oar rowed in the fore-part of the boat and one Aino at the stern steered; the two Japanese superintended. When we had everything ready for starting we were told to wait a while for the tide to rise enough to take us over the bar at the mouth of the river; and we finally left the hotel a little before ten. We had rowed hardly a quarter of a mile when we were aground on the bar, and though the whole crew jumped into the water and pulled and pushed with might and main we could not stir. It was not to be high tide until two o'clock; so, after a good trial of strength, a messenger was sent back for a smaller boat to lighten us. It came soon, rowed by some Ainos, three of them again young women; and when they had taken us passengers and part of the freight, and had joined their forces to those of our own crew, the big boat was at length moved over the bar; and we boarded her again, and fairly started about half-past eleven.

The water was very smooth and the wind though not with us was very light, and by rowing steadily we had at a quarter-past-four reached Horotomari, only three ri as we were disappointed to learn. Still the boatmen, who had hardly yet attained to our exalted idea of the great value of time, wished us to stop here for the night as there would be no place nearly so good beyond that we could reach, and the morning breeze from the land would take us along quickly enough to make up. So we greenly enough consented on condition of their starting very early. We were lodged in the small "banya" or manager's house which, with a store-house and two or three Ainos' houses, make up the hamlet.

"Banya" means literally watch-house, or still more literally turn-house, that is a house where one or another by *turns* keeps constant watch or oversight, and it is the name given to the houses all along the coast, one at

almost every hamlet, where the fishing business is superintended or managed. Sometimes such houses serve as a hotel, there being no other so suitable; and at the more important points the old honjins generally, if not always, seem really to serve as banya also. Even in very small places, then, there is the possibility of lodging in a banya, which however poor is sure to have one or two small rooms or corners of the huge common room that are furnished with clean mats, and are therefore very comfortable, decidedly more so than a tent; which on the other hand is much pleasanter than the vile accommodations to be found in the backwoods of some other parts of the world. The unfinished walls of my room at the banya were hung round with blue and white broad-striped canvas, which reminded me of the custom of our ancestors three hundred years ago of hanging arras round the best rooms. Nevertheless, some assert that our modern custom of pasting paper on the wall instead of such hangings was brought to Europe from Japan a couple of hundred years ago.

Chietomai, 24th September.—The next morning (6th September), the weather was still fair and the water smooth, matters of such importance that we kept on our journey, although it was Sunday and we needed rest. It was half past six by the time we started, and as the promised favorable breeze was lacking the rowing was continued. At the end of an hour and a half, however, the big mast was set up and a large tattered sail of matting was hoisted; and the rowers rested for an hour. The breeze then dropped down and the rest of our boat journey was made with rowing.

The land as far as Horotomari had been low with a wide sand beach and a bluff, the first half of the way perhaps twenty feet high and the other half fifty; and with a view of Sharidake, evidently an old volcano,

perhaps 2,500 feet high, a short distance back. But very quickly after leaving Horotomari the land near the shore grew hilly, higher and higher, up to 300 feet or more, and the sand of the beach was replaced by blocks of stone. Further back was a range of mountains with two or three high pointed peaks. The hills along the shore grew more and more rocky, until at the end of three hours we were under high beetling cliffs of dark-gray volcanic columnar rock. Rounding a point there we passed the little banya of Ushiungushi at the head of a cove, three ri by the mountain road and four and a half by sea from Horotomari. Then the pebble beach was renewed for a space with less rocky hills behind; but soon we came again to cliffs a hundred feet high made up of just such greenish-gray tufa pebble rock as we saw last year near the Kayanoma coal field. Such cliffs were repeated here and there until we reached Utorutsukushi, about six ri from Horotomari, soon after even. There we stopped an hour to take aboard a windlass for hauling our boat ashore, and to give the Ainos a chance to cook and eat their lunch. There were a couple of Aino houses there; but all were empty, as the salmon fishing had not begun. The rock of the cliffs proved to be a dark-gray cellular (no doubt trachytic) volcanic rock with steep cliffs and a south-easterly strike. Up to this point there is (as it turned out) a rough mountain road to Horotomari, and thence along the sea shore to Shari, and there would be no difficulty in making one all the way along the shore except for some 500 yards of cliffs without reefs below near Ushiungushi and for the rather large blocks of stone on the beach in some other parts.

We were off again before half-past twelve and in about a mile passed the old banya of Horobets on a long beach; then rowed under high cliffs of dark-gray volcanic rock with big caverns until we reached Yuwōbets, eighteen

miles and three-quarters (7¾ ri) from Horotomari, at 2 o'clock. Here again the boatmen insisted that we would better stop; for a brisk breeze had arisen, and they said, as there was no other chance to land for a couple of ri, we might get blown out to sea. The navigation along this exposed harborless part of the coast is so uncertain that the best weather of all is considered to be a perfect calm so as to admit of rowing to the best advantage; a land breeze blows out to sea, a sea breeze makes the water too rough. So we pitched our tents with some difficulty in the wind on the beach; for there were no houses. The gale rose in the afternoon and night so that the tents could scarcely be kept from blowing away by fastening them to numbers of heavy stones.

The next morning (7th September), the wind was still so violent that we removed the tents a couple of hundred yards along the shore to the shelter of some cliffs, where there was found also a fine spring of water. The rock was a dark-gray trachytic porphyry with many crystals of glassy feldspar (sanidin) and some grains of pyroxene (or possibly amphibole) and a few minute grains of magnetic iron ore. The sanidin was in some places tinged red so as to give a reddish color to the beds of rock. The dip was 55 degrees S. 50 degrees W.

About noon the wind died away, and after lunch our boat was launched, and we started again about half-past one. We rowed to Kamuibets in two hours, all the way under very high cliffs of gray volcanic (trachytic ?) rock, except the last mile which was along a stony beach under a grassy bluff of light-brown gravel of some fifty feet in height. The cliffs were sometimes cavernous; and sometimes were blotched with deposits of a white substance, which was probably native alum (kalinite); for some days afterwards near Awashiri we found what appeared to be the same thing in an accessible place.

Kamuibets, a brook half-a-mile beyond the somewhat larger Itashibeoni brook, was the end of our boat journey towards the sulphur, and as it was declared by our Aino guide to be impossible to pitch our tents anywhere on our way from the seashore to the mines, we pitched them at once, and the boat was hauled ashore by five o'clock.

The rocks here were still trachytic; and we were told that only similar rocks, volcanic by the description given, and as seemed otherwise almost certain, were to be found along the coast all round the promontory to Shibets; but that they were somewhat reddish near the end of the point. There would clearly be no need of prolonging this tediously slow voyage for the sake of verifying the volcanic character of the rocks beyond the sulphur. The distance from Kamuibets to the end of the Cape is called five ri.

Soya, 25th September.—The next morning (8th September) before half-past six Mr. Akiyama and I set out on foot for the sulphur mines, called two ri distant, accompanied by the two Japanese coolies to help in surveying and by two Ainos (one of them the guide) carrying four meals of cooked food and blankets, so that if necessary for finishing the surveying we might bivouac near the sulphur. The Ainos also carried two Japanese jugs of water; for we soon left the stream of the Kamuibets and climbed the hill to the east. The sulphur is in a small valley parallel to the Kamuibets and not far from the sea, but the lower part of that valley is inaccessible from the sea shore on account of high cliffs. We had not climbed far in the hills before the guide lost his way, as the path was much grown over and he had not been there for a long time. After a fatiguing walk across ridges and ravines and through brush we came out, however, at length on the sulphur brook at the bottom of a deep narrow steep-sided valley. The sight of a fine stream

of clear water was most welcome to us in our thirst, and we stooped eagerly to drink; but the water was as sour as vinegar, evidently with sulphuric acid, and drinking was out of the question. Our expectation too of finding drinkable water beyond was here destroyed, and I began to regret the freedom with which I had already let myself be indulged with the water of one of the jugs; when all at once crack! smash went the other full jug, as the guide rested his burden against a big stone. Drinking water immediately rose in value almost to its weight in gold, and we saw that we must economise. We toiled up the rocky channel of the brook in a southerly direction, three or four times climbing round or over waterfalls from fifteen to thirty feet high, passing some hot springs and some cold springs, all sour, and at length reaching a small branch valley on our left near the head of which was the sulphur. But even above the branch the main stream was undrinkably sour. The climbing now became still steeper, but the footing easier; and at last by half-past eleven we reached the lower end of the sulphur some 1,700 feet above the sea. We saw at once that the surveying could be despatched easily in time to return to camp the same day. We left our loads, and with our lunch walked on up the hill and over the sulphur to a place sheltered from the strong cold wind on the further side of the ridge to the top of which the sulphur reaches.

On the way up we looked with astonishment and admiration on the source from which the sulphur comes. It is a large hole in the midst of the deposit, about one-third of the way down from the top, and is perhaps a hundred feet in diameter and thirty feet deep, and at the bottom has a smaller hole, perhaps twenty feet long and fifteen feet wide. The smaller hole is full to within perhaps five feet of its brim with a dark brownish-gray,

muddy-looking liquid which is boiling violently and spouting upwards for several feet in great commotion, and sending out heavy fumes of sulphur that hide the view much of the time. The liquid would appear to be nothing but melted sulphur; in the whole branch valley there was no water to be seen. Moreover, water could not exist at that temperature in such a place without quickly turning to steam and disappearing; and no steam is noticeable in the fumes. They, on rising from the hole, are blown sometimes one way and sometimes another, and have dropped powdery sulphur all about within a space of somewhat rectangular shape about 250 yards long from top to bottom and 150 yards wide across the valley, which here is broad and shallow and slopes steeply westward falling about 325 feet from top to bottom of the sulphur. There are no plants here and the ground is covered with rough blocks of stone one foot, two feet or even six feet or more in diameter, a gray volcanic rock, trachytic porphyry, containing sanidin. Among these stones the sulphur has gathered to irregular depths, in some hollows quite covering the stones, like a snow drift. In some places the sulphur is burning quietly at a depth of a few inches below its surface and sending out fumes by small holes. Further down hill the sulphur has been washed by the rains down the bed of the stream now dry, and has collected into a solid, pretty pure mass a foot or two or even three in thickness, but only a few feet wide though perhaps a hundred yards long. The whole space covered, wholly or partially by the sulphur, is about eight acres (9,600 tsubo), and the average thickness we estimated to be perhaps half-a-foot of pure sulphur, hardly more than that, perhaps less. That would give 3,200 cubic yards of sulphur powder, or say 3,200 tons (20,000 koku), which at Hakodate would bring (at 300 riyo the hundred koku) 60,000 riyo.

The place was worked in the summer half of the year for a year and a-half and was abandoned in 1867, they told us. The sulphur unrefined (in the absence of fuel and furnaces at the mines) was carried on the backs of men, five kamme or 42 pounds to each man, down the steep, rocky, slippery brook and over the hills to Kamuibets, where there was a house. The men made one trip a day, going to the sulphur, digging it and returning; for there was no lodging at the mines and water had to be carried as in our case. The cost of carriage was so high that the work was given up. Very flattering accounts of the place were given us last winter at Yedo and a visit to it appeared to be quite indispensable. It seems, indeed, to be much the richest volcanic sulphur place in Yesso, and although the gross value of the sulphur is not large and would be in great part eaten up by the cost of working and of bringing to Hadodate in vessels that would have little or no return freight, yet a small economical working might perhaps pay a little profit. The carriage to the sea shore could be made much easier by placing a few ladders at the water-falls, and perhaps by setting up a hoisting apparatus at the cliffs on the sea shore at the mouth of the sulphur brook; or the sulphur could be carried over the hills by horses. The experiment might easily be tried of dipping out the sulphur from the big boiling cauldron by means of a long wooden ladle or a bucket at the end of a long piece of timber worked somewhat like a dredging machine, or perhaps by means of a pump. It is impossible to say how long the supply would last in that case; but it seems likely that it would be immense, since the portion that falls on the ground must be only a small part of what rises in fumes from the hole and that must be little compared with the quantity below. To what depth it reaches can only be judged by the apparently great heat, perhaps several

miles, though very likely not all the way down so regular in shape as at the top nor exactly vertical, but splitting up into irregular fissures. On removing sulphur from the top the remainder would probably be forced up from below to the same level. For every thousand feet of depth there would be some 13,000 tons (80,000 koku) of sulphur; for every mile of depth, 68,500 tons (420,000 koku). How large the reservoir of sulphur below may be it is of course quite impossible to tell.

Tomamai, 1st October.—We ate our lunch on the leeward hill side, and tried several small basins of rain-water that had gathered on the hollow top of large blocks of stone; but all, even at several hundred yards distance from the sulphur and so sheltered from its influence, were too sour to drink with pleasure. After a little rest we made with prismatic compasses and aneroids a rough survey of the limits of the sulphur deposit, Mr. Akiyama taking one side and I the other. Then, after packing up some small samples of the sulphur and of the rock, we set out for the camp again.

Near the lower edge of the sulphur were some stunted five-leaved pines, the same that we found at the Kaitaku-toge between the Ishcari and the Otopchi; perhaps, however, not exactly the same as our American five-leaved, white pine. But we took especial interest in the white checker-berry that grew in such abundance all the way for several hundred yards downwards from the sulphur that you could in many places strip off by the handful the delicious, spicy, firm, but not very juicy berries. We had eaten some of them on the way up, but feasted on them still more freely on the way down and carried some to camp. They are larger than our American checker-berry, have more flavor and are on the whole decidedly superior to it. It is quite curious that we have found the white berry in Yesso at two or three other places, at Iwaonobori

(near Iwanai), at Nuburibets and at Esan; at every place near a deposit of sulphur. At first I supposed its rarity, (even the Ainos are unaware that it is eatable), was due to its growing only at very great heights; but at at Nuburibets it was abundant at only some 900 feet above the sea, and below the Itashibconi sulphur it was found here and there at even a lower level perhaps. We have climbed many other mountains to a greater height, but have never found it without sulphur in its neighborhood. It seems then to be favored in its growth by the acid sulphur fumes or water; or else possibly less injured by them than the other plants with which it has had to struggle for existence and which, with such aid, it has been able to withstand. At Iwaonobori we found also a red checker-berry, juicier but softer and less highly flavored than the white, and hardly superior to our American kind, which it resembles in color.

At about a quarter of a mile below the lower end of the sulphur and perhaps thirty yards below the mouth of the small branch valley, and at about 1,250 feet above the sea is the uppermost and largest of the hot-springs that we saw. It discharges perhaps two cubic feet (say 16 gallons) a second, pouring out of the gray volcanic rock. The water is very sour and very hot and steams strongly. Without a thermometer we guessed the temperature to be 80 degrees C. About fifty yards below that is a much smaller, but still hot and sour spring issuing in like manner from the rock. Again about twenty-five yards below that is another small sour spring with a discharge of perhaps one cubic foot a second, not quite so hot, perhaps 50 degrees C. No gas bubbles nor concretionary deposits nor white sulphur nor iron rust were noticed in connection with any of the springs. Along here the brook flows over solid rock for a hundred yards together; but the dip is difficult to make out; it seemed to be perhaps 45 degrees

N. 50 degrees W. At the point where we finally left the sulphur brook, about three-quarters of a mile from the sulphur and perhaps a quarter of a mile from the sea and about 450 feet above the sea level, there was a large cold spring with a discharge of perhaps three cubic feet a second; it was also sour, to our great disappointment.

On our way back over the hills we succeeded in following the old road almost all the way and found it much easier walking; and we reached camp about half past five. I counted my steps; and found the distance from the sulphur to the mouth of the Kamuibets to be about two miles, or 30 chô, instead of the two ri it had been called.

Half a mile after leaving the sulphur brook we found in the dry bed of a rivulet about 450 feet above the sea an exposure of dark gray volcanic rock that dipped some 20 degrees N. 50 degrees E. The highest points we passed over were about 550 feet and 700 feet above the sea.

The woods which began with small brush near the mouth of the small branch valley of the sulphur brook were continuous the rest of the way until close by the sea shore; but though larger at a greater distance from the sulphur and at a lower level were throughout only light woods.

The next morning (9th September) the sea was pronounced quite too heavy for our navigating powers; and it was wholly uncertain how many days we might have to wait for satisfactory weather. So I suggested a return by land on foot; judging by the real length of the reported two ri to the sulphur mines I thought we could probably reach Utorutsukushi the first day and Shari the next. As we had at starting from Shari planned for no such emergency it was for a while questionable whether we could carry our luggage and enough food. After some consultation and cipher-

ing we found it possible to leave one sick Ainu and one of the Japanese boatmen and the large coolie tent and some superfluities behind with the boat, and to carry with the rest of the Ainos and our two coolies all our baggage and three days' food; and we therefore began at once to strike the tents and pack up. It was a long time before all the loads were finally adjusted, and almost every one of them was a very heavy one (in fact too heavy); and we did not really start until about half-past nine. The first mile along the sea shore, though rough with blocks of stones, was comparatively easy, though requiring a long rest at the end of it for the loaded men and women. But then began the difficulties of the journey with climbing the steep hill to avoid the cliffs along the shore.

The height of the hills was much greater than it had seemed from the sea, and we passed over summits first of five hundred feet and afterwards of seven hundred feet in height above the sea; but without descending deeply into hollows between. As none of the party had even in hunting been over the ground before we did not go as directly as might otherwise have been the case; but went winding about, pushing with might and main through bamboo thickets and swampy ground, or turning aside to avoid them. Sometimes we came near to the sea shore in hopes of seeing some sign of Yuwôbets, but were long disappointed. We had to stop very often indeed to rest on account of the great weight of the loads and the roughness of the ground. Instead of lunching at Yuwôbets, as I had hoped, we arrived there with great difficulty at nightfall, nearly seven o'clock, and almost worn out with fatigue. Nevertheless I had by counting the steps found the distance (though much more than I had conjectured) to be but about two ri and a-half; by sea probably two ri. By that and our

other experiences of this year where I have found the distance by counting my steps, I am satisfied that such walking in the woods without a path is about four times as difficult as walking the same distance on a good smooth wide road.

We pitched our camp in our old, first place on the beach and the Ainos in the absence of the big tent had an empty Aino house not far back to resort to, not fancying the shelter of the overhanging rocks which seemed to me quite as good as a tent. But our servants and coolies, like the Ainos, seemed even in the warm summer to prefer to sleep in a tent that was shut up as closely as possible, though crowded. We were glad to eat our suppers as fast as the single kettle we had brought could cook the rice.

The next day (10th September) the single kettle could not let us start before eight, but then we pushed on and climbed to the top of the high land above the cliffs. The hills, however, were lower to-day, only 320 feet, 450 feet and 420 feet high, and not very deep hollows between. We also had for a time a hunter's blazed path, and our own men knew the ground here better. About noon we had reached (in about a ri) the mouth of the Horobets a stream of perhaps a hundred cubic feet of discharge in a second; and there we lunched in sight of Utorusukushi a mile and a-half distant along the beach. We were rejoiced also to see that in our absence some boats had come there to begin the salmon fishing; and we could make the rest of the journey by sea as the water had become smooth. In fact we quickly reached the Banya there, four miles (1.6 ri) by my steps from Yuwōbets, say a ri and a-half by sea. They told us that we should probably have been at least a day later if we had waited to come by water; so we had for our pains the gratification of having saved so much time.

The boats had come only two days before and the first net was to be cast that night. We were furnished with a boat smaller than our other one, and with our Japanese boatmen and five Aino rowers, all men, we started once more on the water before 3 o'clock. The other Ainos were to go back for the big boat as it was wanted as soon as possible for the fishing. About half-past five we reached the Aino village of Onnebets, half a dozen houses, and pitched our tents on the beach there, just across the brook. A young Aino at once waded over to us hospitably with a burning brand to light our fires. Two or three of the older men of the village also came to help in pitching the camp and to make their salutations. One man was sent off to Shari to bespeak horses for our journey beyond, and if possible to have them come out to meet us, as they could go quicker than the boat.

The houses of Onnebets had the peculiarity of a rude kind of chimney, a grass-built enclosure four or five feet high round the large smoke opening in the roof. The introduction of the art of building chimneys seems to be highly important to the comfort of the inhabitants of Yesso, and consequently to its popularity as the destination of Japanese emigrants, and to its rapid settlement. Although wood is much burned even in the main room of the hotels instead of charcoal, there is no chimney, and the smoke escapes by a great hole in the roof, which must also let all the warm air escape at the same time; or if somewhat closed must let the room fill with smoke. The upper part of the room is always black with soot. Even the large chimneys common in American backwoods, built rudely of stone or still more simply of logs and mud, must be a source of greater warmth and comfort than the system in use here.

The next morning (11th September) the water was smooth with little or no wind and we were off before

seven. In an hour and a-half we passed an Aino on the beach who said the horses were coming out to meet us, and not long after on rounding a point we descried them in the far distance, a welcome sight. We reached Horotomari (three ri from Onnebets) within half an hour after their arrival and in less than fifteen minutes had started again on horseback, before 10 o'clock. With a good level road, most of the way on a hard beach, we arrived at Shari long before noon. But the baggage came later, and we could not set out that day northwestward.

The Ainos also arrived in the afternoon and were paid off in the hotel yard with goods of various kinds, rice, cotton-cloth and the like. Two or three shy women, strangers to us, came to take certain portions of the pay probably on behalf of those we had left behind. Before those who had been with us went away they came in front of my door to make their parting salutations in Aino fashion, but somewhat abbreviated from the manner we had witnessed on the Ishcari. There two Ainos on making acquaintance for the first time would squat opposite each other on the ground and looking at each other with very grave faces would rub each his own hands three times slowly back and forth, then would make each one with both hands open three motions from near the ground half way towards his own chin, then three similar higher motions so as quite to stroke the beard, sometimes winding up with a movement as if putting aside the earlocks. Then the eyes would wander away from the fixed gaze and the new-comer was ready for the salutation of somebody else. There seemed commonly to be no eager entrance into conversation immediately after the ceremony, no inquiries after health or news. In merely passing a strange Aino on the river or on the road, even if some inquiries were interchanged, there was no such elaborate form gone through, indeed apparently none at all,

Tomamai; 2nd October—As regards the Ainos anything whatever, even though it may seem by itself to be altogether trivial, still if it directly or indirectly tends in the slightest degree to elucidate their origin and affinity with other races, their mental and bodily characteristics, is both of great interest to ethnological science and especially of much importance to the Kaitakushi, which has in its hands not only in a great measure their present welfare but the privilege of beginning their future civilization and enlightenment. I shall therefore take pains to record from time to time somewhat minutely (as I have done in former letters) what I have been able to observe or to learn in respect to their natural history, their customs and their character.

In regard to their hair some travellers have thought it seemed finer and blacker than the Japanese; and others, coarser. But an occurrence in a dish served me at dinner at Wakkaoi led me to make a microscopic comparison of the hair of my two Japanese servants and of three Ainos who were then with us. All three Ainos had hair of about the same thickness, and in that respect came between the two servants' hair, differing but little from either. All five samples were quite black except one of the Ainos' which had a faded brownish appearance. All were very much thicker than the only hair of European origin (my own) with which I could compare them. One of the servants' hair was slightly curly or wavy; some of the Ainos have it very much so. One we had in the early part of our Ishcari trip had hair and beard almost as wavy as those of a mulatto. The eldest of the three Aino women on our sulphur excursion also had very wavy hair which consequently stood out in all directions from her head in the most striking manner. Since leaving the Tokachi (in the same way as I remarked before

that) we have met with a great number of cases of bald, or partially bald, Ainos, often quite young, evidently the result of some common disease of the scalp.

All three of the young women on our sulphur trip wore no band round their head to confine the hair as the men commonly did; but went quite bare-headed; and the hair was cut square off just above the shoulders. The two women with straight hair had it parted, as customary with the Ainos, in the middle, and it hung down smoothly without any mop-like appearance more than is usual with the Ainos.

In the statement I sent you of the measurement of the dimensions of our Ainos at Ohotsunai you noticed no doubt with regret the lack of such information in regard to the other sex, and you may think perhaps that I was able to supply the defect at Shari. But leaving the young women behind so unexpectedly on our way back was itself enough to prevent so desirable an investigation, even though they had been willing to permit it. It was noticeable that when all our crew jumped into the river when we were trying to cross the bar, the men all stripped to their waist cloth, while the women only replaced an outer garment (which they wished to keep dry) by another coarser one, disclosing in doing so an inner, thin, dirty, blue figured cotton loose garment of like shape as all the other Aino clothes; and that inner one was not removed at all. It is plain then that among Aino women there exists the desire to conceal the greater part of the body.

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The three Aino women of our boat crew, though, as you might expect, without much refinement, seemed to be of respectable character enough. Without being handsome, as one or two of the men really were in a remarkable degree, they yet shared to some extent the good looks

that are so far from being rare among their race. The youngest was perhaps eighteen and was called by the other Ainos "girl" (musume), and was probably unmarried. She was a "gay and happy" lass whose frequent laughter became her well. The other two were married women, the younger (perhaps twenty) with a slightly haughty or disdainful expression of face, the other (perhaps twenty-five) with a rather broken-spirited one; though both were not wanting in laughter. It was the last mentioned who had the singular head of hair, which by its seeming neglect of appearances rather added to the effect of her disheartened looks. Although probably still young she had begun already to have the features of age.

The women rowed industriously, were always ready at their post, and shouldered their burdens on the march without the least sign of complaint. They carried enormous loads, though not so strong as some of the men nor so tall as any of them. During the foot journey I asked if such exhausting work did not prevent their bearing children, and was answered that the younger married woman was just then pretty far advanced in the family-way. Not much special consideration for the women was shown by the men while at work; but still now and then a little, such as might pass for a trace of gallantry, possibly brotherly or fatherly kindness towards a weaker relative.

The men of our party showed no striking peculiarities beyond what I have previously remarked concerning the Ainos. As we approached Ushiungushi the first time we met a smaller boat with two or three Ainos, and they furnished our crew with some fresh fish, about half a dozen large masu (salmon trout?). In return our men handed over in a cloth perhaps three pints of boiled rice, small compensation as it seemed. No bargain

seemed to be made but the fishermen looked well satisfied. In travelling with the Ainos and passing Aino houses and villages, I have never been able to notice any special display of hospitality, no invitations to our Ainos to enter and share the food, drink or other good things of the householders. On the other hand the impression has been produced that a strange Aino in passing was considered quite at liberty to help himself to whatever he stood in need of. Still on our first visiting Yuwôbets the Ainos seemed scrupulously to abstain from entering the unoccupied Aino house near by and from using any of its furniture; and I am not sure but that they did so even on our second visit though without their tent.

While the Ainos were rowing singing was constantly kept up in much the same manner as we have seen elsewhere. The songs consist of but a few syllables, each say half a dozen, which are repeated over and over again in different keys and manners for ten or fifteen minutes together. Then some one of the crew interrupting will strike up another song and tune and the rest all join with him. Sometimes they divide into two sets of voices, one singing the short song and the other repeating it in just the same manner, or else singing another part or answer to the same song. In our boat the women or sometimes one woman would sing one part in a shrill, cracked voice and the men would sing the other. Last year I was told that these songs had sometimes no meaning, were simply refrains like our "tirala;" but on this trip the meaning of one of the favorite and most frequent songs was given to me. It was a short invocation of a god of wealth or happiness. Strange that these poor creatures, the very pictures of hopeless poverty you would say, should spend so large a portion of their lives in calling on the god of wealth!

Happiness, however, is not by any means wholly wanting to them with their gay and cheerful disposition. As to their habit of langhing, on the occasion of anything whatever that seems striking to them, a good illustration, quite parallel to the one given by Wallace in his account of the Papuans, was witnessed by me the morning of my arrival at Bekkai. I had come alone and, having arrived unexpectedly soon, asked a Japanese boy on the ferry boat if that was Bekkai. The Aino man at the other end of the boat instantly ducked his head with a quick movement; and with difficulty suppressed evidently a roar of laughter, at the idea that any body should not recognise Bekkai at first sight, a place he had known his whole life long. The incident was well worth the whole morning's ride; and was owing to the fact of my being without companions.

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It was worth a day's ride to see the flash of the eye and the warmth with which a certain landlord from Nambu answered my question whether that was a better country than this. He did not seem to lay so much stress on the greater mildness of the climate there; evidently there is still something for the Kaitakushi to do in making Yesso attractive, either by increasing its population, or possibly in still other ways.

Tomamai, 3rd October.—On the 12th of September, we rode to Awashiri, twenty-three miles and three-quarters ($9\frac{1}{2}$ ri). The first two-thirds of the way were over a nearly straight, monotonous, sand beach, hard and very easy for riding, bordered by irregularly-shaped grassy sand hills, twenty feet or so in height with woods, apparently light, some distance back, and with only one Aino house on the way. Then came a ferry and a small village of a dozen houses, almost all Aino houses; and from that onward still a good beach road, but on the

left land some twenty-five feet high with a grassy bluff towards the sea, and with light-looking woods back. The bluff gradually grew higher to forty feet and the land more broken and the shore less straight, forming a cove where a banya and several store-houses were placed, and already eight or ten Ainos' house had been passed. Then the shore was strewn with blocks of dark-gray trachytic rock which also formed reefs in the water; and at length, half a mile before reaching Awashiri, we met with a high, light-gray cliff that cut off the beach road and obliged us to climb over a flat-topped hill, perhaps a hundred feet high, to the village at its foot on the other side, by the mouth of a wide river of perhaps 150 cubic feet of discharge in a second.

The cliff is made up of light-gray trachytic porphyry, with a very light-gray paste and with numerous very small sanidin crystals and many long (0,02 foot) slim crystals of dark greenish-black hornblende. The rock is broken up into short columns half a foot to a foot in diameter which are very confusedly mixed in direction and often bent, but in general are inclined, say 60 degrees about north-east.

There is an island perhaps 60 feet high apparently of the same rock in the sea opposite the village and perhaps half a mile distant. The rock is light-gray, is an irregular mass of short columns, and forms a cliff on all sides. The top is rounded and below is a wide reef all about, so that the outline, as sketched from one side at low tide, looks like that of an old slouch hat with a broad brim.

The village is small with a government office, a score of Aino houses, a half dozen store-houses and an admirably clean, fresh-looking hotel.

The 13th of September was Sunday, and the temptation was strong to stay in so comfortable a place, and besides,

as we were not on a short journey of a few days, but travelling constantly month after month, we needed occasional rest; but at this season the weather is very uncertain, and on that part of our way the stages were rather short, so as to require many days of riding, and it seemed best to take advantage of fair weather when it came, even if that should be on Sunday. We rode therefore to Tokoro that day, 17½ miles (7 ri).

We crossed the river at Awashiri by a ferry, and having there a fine view of the mountains on the peninsula of the Itashibeoni sulphur I took their height by vertical angles of the pocket sextant. The outermost high peak (Charasenobori?) proved to be about five thousand and five hundred feet high; the next one, Itashibeoninobori (on whose northern flanks the sulphur is found), about six thousand and five hundred feet high; the next, Chachanobori, also about six thousand and five hundred feet high; and the next (Unabetsudake?) about five thousand and five hundred feet high. There was no water horizon between us and Sharidake, but it would seem by comparison with the others to be about five thousand feet high instead of half that as I at first guessed from near Shari. The names of Chachanobori and of the sulphur mountain are transposed on Matsura's map.

Awashiri is built on a narrow flat and opposite is another wide one; but a few minutes brought us along the beach under high bluffs with cliffs here and there, perhaps a hundred feet in height. The rock was a gray trachytic tufa sand rock or fine pebble rock, weathering light-brown or buff in parts; and at some points covered near the bottom in spots with a thick, white efflorescence which seems to be native alum (kalinite). The dip at one place seemed to be 60 degrees southwest.

In a few minutes more the cliffs quite cut off the beach and we had to climb to the hill top. We rode for perhaps

four miles (a ri and a half) over the rolling upland, a good part of the way through fine, heavy, tall, straight fir timber, almost the only good timber we have seen this side of Shari; but it soon dwindled to mere brush and was followed by a prairie half a mile long. We were perhaps a hundred and fifty feet above the sea, and a hill on our left rose something like a hundred feet higher. Near the end of the prairie we came down to the beach again, at a high cliff of dark-gray fine grained trachytic shaly rock weathering light-brown and buff and yellow and with a dip of 35 degrees N. 80 degrees W.

We rode for a mile or more under similar cliffs, interrupted here and there and afterwards more and more by grassy bluffs. The heights then came to an end, and we rode along a sand bar some twelve feet high that separated a large lake from the sea. Then under low grassy hills of blown sand, followed by bluffs up to fifty feet in height, having here and there small exposures of volcanic rock, similar to the last and seeming to dip about 45 degrees southeast; then under less rocky grassy bluffs only fifteen or twenty feet high until we came within a mile or so of Tokoro. There we found low cliffs and long narrow reefs of greenish gray tufaceous sand rock weathering brown and buff and with clear dips and strikes; at first, 25 degrees S. 45 degrees E., with reefs of a strike N. 45 degrees E.; then a dip 60 degrees southerly, and then strikes of S. 80 degrees E. As we came nearer to the village the narrow reefs showing the strike curved round beautifully from N. 80 degrees W. to more northerly; and at the ferry was a small exposure with a strike of N. 45 degrees E. and a dip of 20 degrees southeast.

On the beach, at one place, we had passed a larger patch than usual of black iron sand, but not enough in extent and thickness to be of any value. We saw still

smaller amounts of it here and there all the way from Shari to Sôya.

In the night a heavy easterly rain storm set in that obliged us to stay at Tokoro over the 14th of September. The rain leaked so badly into my room as to make it quite untenable; but my companions, with their usual thoughtful consideration, gave up their room to me. We spent the day in report writing and copying, in translating and in plotting the Itashibeoni survey.

The village seemed to be but three or four Aino houses besides the hotel, which was but a small one.

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Tomamai; 4th October.—On the 15th of September the weather was fair again, and we rode to Yūbets, 24 miles (9,6 ri).

After riding for a ri or more along the sea shore, but chiefly behind a single or double barrier of irregular wind blown but now grass-covered sand hills sometimes as much as fifty feet high, we reached a river with a narrow outlet but widening above to a large lake. On our left had been thick low oaks with taller but apparently light woods behind. We crossed by a ferry a few hundred yards above the mouth and kept on the lake side of the narrow bar of sand between us and the sea. The bar rose in the middle of its breadth into irregular, grassy sand hills, and after a little distance becoming wider was covered in great part by a thick growth of dwarf oaks. We rode some ten miles (4 ri) along the shore of the lake, which at the widest place is about two ri and a-half wide. Although the river was said to be but ten feet deep at the ferry, the lake was reported as 120 to 180 feet (20 to 30 ken) deep. As the point where we finally (still at a wide part of the lake) crossed the bar to the sea shore the width was only some fifty yards and the height some twenty-five feet. It would be an

excellent place to make an artificial harbor, if the needs of commerce should ever require one on that coast so destitute even of places of refuge for vessels passing in doubtful or bad weather. The place was closely similar to some that I have seen on the coast of Cape Breton, in regard to one of which a report as to its capabilities for becoming a harbor was written by my friend Mr. J. C. Trautwine, so celebrated in such engineering matters. If I remember rightly the cost in that case of cutting through the bar and protecting its sides and the long projecting seaward entrance with wooden piles was estimated at something less than one hundred thousand dollars; the cost of building with stone somewhat greater, but for permanent work probably cheaper in the end, owing to the depredations of the ship worm on wood placed in sea water. His plan was never fully adopted, but a much cheaper, less serviceable work was carried out and a harbor made. But in our case here the difficulty would be even less because the bar is narrower and the water on either side apparently bolder, so that the cutting and the length to be protected would be shorter. The lake too is so large and deep as to leave no fear of its silting up for a very long period. As far as ease of construction is concerned, it is much the best place for an artificial harbor that we saw on that coast; although there are two or three smaller similar old bays or coves now closed by a sand bar on the seaward side. Still although smaller and shallower than this one they may at some future day be worth opening, when the population and business prospects or naval requirements of the island seem to demand it.

After leaving the lake we rode through the same country of irregularly shaped grassy sand hills up to thirty feet high along the sea shore; with lower ground behind and with dwarf oaks beginning a few hundred yards back

followed apparently by light woods behind. At last we reached the hotel and three or four Aino houses that make up the hamlet of Yubets, close by the sea shore. We had passed scarcely a house on the way, one or two at the ferry, and half-way by the lake side a resting house fitted up for our accommodation. The others stopped to lunch there and arrived at Yubets three hours after me.

Not a rock was seen the whole way; but the coarse sand of the beach at Yubets still seemed to come wholly from volcanic dark-gray trachytic rocks. There were many pebbles to be sure of blackish quartzite, but we have found them to be enclosed very often in the trachytic rocks; and since that have found tufaceous pebble rocks containing large quantities of such quartzite, the same blackish stone that we found in such abundance on the upper Ishcari. On inquiry at Yūbets we learned that no such black rock was to be found in the high picturesque mountains that we saw across the big lake, but that the rocks there were white and light-gray like those of Awashiri and by the description evidently volcanic rocks, probably trachytic porphyry.

The 16th of September on leaving Yūbets for Mombets, 16½ miles (6,6 ri) distant, we crossed almost at once a ferry of some fifty yards, and kept on along the sea shore, still among low sand hills and with low flat ground back and with light-looking woods half a mile from the shore. At the end of a couple of miles we rode for half a mile or more along a narrow sand bar that separates from the sea a large lake that reaches back perhaps a mile. In a few hundred yards we came to another such lake reaching perhaps even twice as far back and perhaps a ri along the sea, separated from it in like manner by a bar only about eight, six or at one place even four feet high and quite narrow. Beyond that still on the beach or on the sandy

grass-covered upland some twenty feet high close by with low woods 150 to 300 yards further back we rode all the way to Mombets, passing a village of three or four Aino houses a couple of miles before arriving there. For the last two-thirds of the way it had been raining gently, and the late comers had still more of it; for it was rainy all the rest of the day.

Mombets is an important place as the capital of the province of Kitami, which extends all along the northeast coast from east of Shari to near Esashi; but the village although having a government office, a very good hotel and some storehouses, seems to consist otherwise only of a dozen or twenty Aino houses.

As the day's journey had been short we worked in the afternoon in copying and translating this report.

It rained heavily in the night and a little the next morning (17th September), and looked so threatening that we did not leave Mombets; but spent the day in office work. I drew in pencil the latitude and longitude lines of a small map of Yesso on which I hope to be able by the time of our return to Yedo to lay down the geology and topography of the whole island, in great part conjecturally, to be sure, but still so as to give a very useful idea of the real facts. Mr. Akiyama began work at once on the outline so given, and as leisure offers is reducing upon it, at one half the scale, the map which our geological assistants made last winter from Matsura's large map, and of which you have a copy. I also did some report writing and the translation was continued.

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Herashibetsubuto; 5th October.—Horses are so rare in the northern part of Yesso that we had to keep the same ones for our baggage from Shari to Esashi. Consequently short stages were quite enough for them, especially as they had to get their food by grazing and browzing

in the little resting time that was allowed them each day. We had relieved them a little by sending the baggage from Awashiri to Tokoro by boat, and they rested on rainy days. As they had rested so one day at Mombets, we hoped to accomplish two stages the next day (18th September), but it began to rain hard before the first stage had been traveled over, and we therefore did not attempt the second, but rested at Sawaki at the end of 18 miles (7.2 ri).

The road was not much diversified. About half-way we passed the very small village of Sharoro, where the hotel was all ready to entertain those of our party who were disposed to rest and lunch there. There were three ferries to cross and the boats and Aino ferrymen were all ready waiting for us and set us quickly across. The road almost everywhere was along the beach, and with a steep, grassy bluff, thirty, forty or fifty feet high, having flat land at the top and dwarf oaks and light woods back, sometimes almost up to the edge of the slope. Near Mombets were one or two hills that seemed seven hundred feet high, a few hundred yards back. Towards Sawaki, a range of high mountains with irregular crest was seen, perhaps ten miles distant.

At Mombets we crossed a headland, and found there a couple of rocky reefs on the two sides of a narrow basin of compact, dark yellowish-brown feldspathic rock with a dip of 20 degrees N. 40 degrees W. on the southeasterly side of the basin, and one of 60 degrees to 70 degrees S. 40 degrees E. on the other side. At Sharoro also we crossed a small headland some fifty feet high, and on coming down to the beach again found some rocks and reefs close by. The rock was the same as before but darker and with small crystalline yellowish-brown grains that seemed to be pyroxene. The dip was about vertical

and the strike of different beds within a few yards of each other varied from N. 40 degrees E. to N. 60 degrees E. With those exceptions we saw no rocks the whole way.

The next morning (19th September), we started off as usual, but by the time I had finished looking at some rocks close by, we perceived that it was going to rain heavily very soon, and as the baggage was not yet fairly under weigh we all turned back. The day was spent in office work, report writing, copying and translating and in mapping.

The rock of the cliffs a couple of hundred yards from the hotel is a very dark gray compact volcanic rock with yellowish-brown and sometimes pale green crystalline grains of what seemed to be pyroxene, and a very few small grains of sanidin. The dip was not clear, but there was what seemed to be a cleavage about vertical with a strike of S. 80 degrees E. In some parts there was a rudely columnar appearance.

Mashike; 10th October.—The 20th of September, although it was Sunday, we took advantage of the fine weather and rode two stages to Chikabutomuushi, 27½ miles, (11 ri), passing the Poronai hotel about half-way.

On leaving Sawaki we crossed within half a mile the head-land, perhaps a hundred feet high, formed by the rock already described, and then rode over a bed of brown sand, with here and there a thin sprinkling of black iron sand below a bluff some twenty feet high, until at the end of half a ri we came to a good-sized brook. At the ford was, below some ten feet of alluvium, an exposure of about ten feet in thickness of dark gray tufa with numerous nut-size pebbles of dark quartzite, and with a dip of some 3 degrees N. 55 degrees E. Then we kept on along the beach of coarse brown sand under a bluff 20 to 25 feet high; and in another ri crossed by a bridge a sluggish, deep-looking stream of some

twenty yards in width in a flat, open, grassy plain half a mile wide and hardly five feet in height above high tide. There we had a fine view of a range of mountains with irregular outline, perhaps five miles (2 ri) distant, apparently of volcanic origin. Half a ri more along the beach under such bluffs as before brought us to a projection in the shore with a ledge and reef of black, shining, feldspathic rock that seems to be pitchstone-pearlite with a strike of N. 70 degrees E. and a dip of 50 degrees northwesterly. A few yards beyond, the strike was N. 50 degrees E. Another half ri brought us to many reefs and an exposure on the beach of grayish-white, hard, compact feldspar with about vertical dip and a strike of S. 65 degrees W. The reefs gave strikes of N. 50 degr es, 40 degrees and 70 degrees E. Still another half ri brought us just after fording the mouth of a deep brook to the banya of Motoenep.

We were told there that last winter a Japanese named Satoö, an officer of the Kaitakushi, with some Ainoes crossed the mountains from Nayoro on the upper Teshio river to Toenep (near Poronai,) in four days, arriving on the 18th of January. They had been on the Teshio river on account of the salmon fishery. The snow was very deep, but the height of the mountain pass was not known to our informant. It is extremely probable that it would be quite feasible to build a road of easy grade all the way from Teshio to Mombets, either by that pass or by one still more nearly in the direct line. The same informant told us that shining, black feldspathic rock like a bit of pitchstone-pearlite we had, was found on the Yūbets and on the Mombets.

Hamamashike; 12th October.—The rest of the way to Poronai, the road was still almost always on the beach under bluffs varying from 10 to 25 feet in height; but crossing three small, rocky head-lands. At those points and

at several others between, rocks were exposed in place, cliffs, ledges and reefs, in all cases old volcanic rocks. At the first place within half a ri trachytic porphyry with sanidin crystals and a little pale pyroxene in a black glassy paste, with no dip clear. A little beyond a very light, gray, hard feldspathic rock (probably trachytic tufa) weathering light brown and buff and honeycombed on the surface; with a dip of 15 degrees N. 45 degrees E. A short distance further the strike of a reef was N. 50 degrees E., and just beyond were reefs of dark gray rock with vertical dip and a strike of S. 80 degrees E.; then reefs and ledges and low cliffs of dark gray, light gray, partly reddish and again dark gray rock without any clear dip; then a wide space without rocks, either side of a deep brook; then another small headland of dark gray rock, with a northerly strike and easterly dip. At the end of half a ri more, a quarter of a mile short of Poronai, was reef of buff volcanic rock, with a strike of N. 50 degrees E. At Poronai, under a bluff some 15 feet high, were low cliffs of light gray feldspathic rock, with a dip of 80 degrees N. 20 degrees W. There was no village there, only the hotel, a ferry and an Aino house. The river seemed to be one of a discharge of a couple of hundred cubic feet in a second.

The road to Chikabutomuushi was still of much the same character, almost always on the beach under a bluff of ten to twenty feet in height, but crossing half a dozen small rocky headlands, one of them as much as fifty feet high, and another by a rather long circuit inland. There were three deep brooks on the way with quicksand and very bad fords. The rocks were exposed at several places and were all volcanic still and apparently trachytic, but, in one case, at least, of especially interesting character.

Five hundred yards from Poronai was a low cliff of a dark-gray, hard, compact, fine-grained feldspathic, pro-

bably trachytic, rock with a dip of 10 degrees S. 65 degrees E. About a ri beyond that, after passing some reefs of gray rock, containing pebbles as large as your fist, we came to another low cliff of dark-gray, compact, probably trachytic rock, with a dip of some 45 degrees N. about 55 degrees W. Within half a ri more we passed a small island of apparently the same a dark gray volcanic rock, quarter of a mile or more from the shore. A little beyond was a low cliff of gray tufa, with pebbles of pea and nut size and with a dip of 30 degrees N. 45 degrees W., and a little further on another low cliff of very dark tufa with pebbles of mustard seed size and with a dip of 40 degrees N. 55 degrees W. In less than half a ri more a small cliff of dark-gray trachytic porphyry with sanidin, with a dip about vertical and a strike of N. 50 degrees E. At the end of another half ri, there was an imperfect exposure of light yellowish-brown tufa with pebbles of nut size and larger. Still another half ri brought us to a small reef of dark-gray volcanic rock, with a dip of perhaps 45 degrees northwesterly. Scarcely a hundred yards beyond, was a small exposure with a strike of N. 50 degrees E. and a dip, north-westerly, of dark gray close grained-rock, perhaps a fine-grained syenite, or a passage to what at length delighted my eyes a few yards beyond.

This was, namely, a very light-gray, coarse-grained syenite, weathering almost white, containing milk white feldspar, glassy quartz crystals, blackish hornblende, and a little blackish mica, all rather coarse grained, a perfect syenite. Its dip was about vertical with a strike of N. 50 degrees E.; a few yards beyond, the dip was 75 degrees N. 30 degrees W. and few score yards further on, it was 45° degrees S. 40 degrees E., forming therefore a basin with dips and strikes conforming well enough to those of the neighboring trachytic rock. We had met

with pebbles of it in many places on the Toshibets, on the Kunnui, on the Horumui, and on the Ishcari, and Mr. Munroe saw the rock in place on the Toshibets. To-day, at last, we find the rock in place again, and under such circumstances as to show conclusively that it is not, as was conjectured at first, from its character, a very ancient rock, but that it is of the same age as the other old volcanic rocks and, no doubt, like them, of trachytic character. The group of rocks mentioned in my report of last Christmas as the Toshibets-Kuril group, was based on that syenite of the Toshibets, and consequently now becomes an unnecessary name since all these old volcanic rocks are no doubt of the same age as the tufa pebble rocks of Kayanoma, for example, which followed the coal; and are older than the recent volcanic rocks and the Toshibets Karafto group of rocks, which are both mentioned after them in that report. We have here another good illustration of what occurs so often in geological surveys, that the facts observed in one place are to be explained sometimes by observations made in another very distant place, and here on the northwest coast we learn to understand the geology of the Toshibets.

On the Ishcari we found proof that the Horumui-Karafto and the Toshibets-Karafto group of rocks of last winter's report were the same. All the rocks of Yesso, then, older than the alluvium and the recent volcanic rocks, are reduced to four groups: the Toshibets Karafto group; the older volcanic rocks; the Horumui Kuril group; and the upper Ishcari or Kamoikotan group (metamorphic, chiefly dark quartzite, the oldest rocks yet found); and they may therefore be called simply the Toshibets, old volcanic, Horumui and Kamoikotan groups. The main features of the geology of the island are therefore much simplified.

Less than half a ri beyond the syenite was a low cliff

of dark-gray, compact trachytic porphyry, weathering reddish-brown, with a dip of 20 degrees north-westerly. The same rock was exposed all along for some hundred yards with a dip of some 45 degrees north-westerly. Then after the long detour inland, after coming to the shore again similar dark trachytic rocks were seen, and in another ri syenite again in place with uncertain dip, perhaps level. Half a ri more brought us to the hotel and single Aino house called Chibakutomuushi. The day's journey was so long and trying that the servants and baggage did not arrive until very late, in part after dark.

The woods all day, as far as could be seen, were but light, beginning near the shore, or a few hundred yards back with a stunted growth of small oaks. Besides what has already been mentioned, scarcely a single dwelling-house was passed perhaps not one that was occupied. Since leaving Poronai, we had crossed the boundary between the provinces of Kitami and Teshio.

On the 21st of September, we rode twelve miles and a half (5 ri) to Esashi. The first two-thirds of the way with a ferry in the middle and one at the end over streams of a discharge of perhaps three hundred cubic feet a second, were equally uninhabited and much like the road of the day before, along the beach under low bluffs ten or twenty feet high at the edge of flat land grassy near the shore, but with light woods further backs, stunted oaks in front. The rocks met with here and there along the shore were interesting as fully confirming the comparative newness of the syenite by its repeated occurrence in alternation with volcanic rocks of apparently trachytic character.

A couple of hundred yards after starting we found some small reefs of the same light-gray syenite, with a dip (apparently not a cleavage) about vertical and a

strike of N. 75 degrees E. Half a ri further on there were small reefs again of syenite that had weathered slightly brown, and with a dip of 60 degrees N. 40 degrees W., also a good cleavage, dipping 45 degrees N. 65 degrees E. A few yards beyond the same syenite formed a reef of blocks running N. 50 degrees E., but nothing to be seen quite in place. A couple of hundred yards skill further on was a reef, some 150 yards long, of fine-grained syenite, with a course of N. 50 degrees E. Thence to the first ferry there were no rocks, nothing but a sandy beach. Half a mile beyond, however, was another reef of brownish weathered syenite, with a course of N. 50 degrees E. A couple of hundred yards further on were great numbers of blocks of dark-gray volcanic rock probably trachytic porphyry; and a little beyond, a reef of scattered blocks of like looking blocks. But a few yards beyond that, we saw a cliff a dozen feet high and some ten yards long of gray syenite, with a very well-marked dip and curved beds. The dip grew steeper from 30 degrees N. 10 degrees W. to 55 degrees N. 10 degrees W. and 65 degrees N. 40 degrees W. then gentler at the bottom of a basin to 20 degrees N. 80 degrees W. Some 75 yards further on, the syenite is very hard with what seemed to be black feldspar very abundant in it; the dip there was about vertical, with a strike of N. 40 degrees E. Again 300 yards beyond, on shore and in the water all about, were large blocks of white rock weathered buff with granitic structure, of feldspar, quartz and minute crystals of hornblende, a form of syenite. A large block near by had large (0,05 foot long) crystals of glassy quartz and what seemed to be concretions that, in section, looked like encrinites with a hole in the middle; in one case a double one; the feldspar of the block is brownish, giving the rock a buff color. A few yards beyond was a reef of what seemed to be a dark-

gray trachytic porphyry with a course of N. 60 E. but without any clear dip. A few yards more brought us to a small reef of gray syenite, also without any clear dip. Another couple of hundred yards further on was a large reef of fine-grained, compact, dark-gray trachytic porphyry, with a dip about vertical and a strike of N. 45 degrees E. and a cleavage dipping about 25 degrees N. about 15 degrees E. A couple of hundred yards beyond was a small reef of reddish, crystalline rock with a dip about vertical and a strike about N. 60 degrees E. A few yards beyond that was a small cliff of reddish, hard, trachytic porphyry, with a little sanidin and with a dip about vertical and a strike of N. 30 degrees E. Within 200 or 300 yards more was a reef of dark-gray rocks in the water, and close beyond, a small exposure on shore of light-gray syenite, weathering buff, but with neither dip nor strike clear. A couple of hundred yards further on, there was a low cliff of dark-gray, coarsely-granular rock that seemed to be a blackish trachytic porphyry, and that had a dip of 75 degrees N. 50 degrees W., and a cleavage dipping 30 degrees S. 40 degrees W. A. couple of hundred yards beyond that, was a small reef of dark-gray volcanic rock, a quarter of a mile short of the second ferry.

From that ferry to Esashi the road was over a wide, flat, hard beach of brown sand bordered by nearly flat land some fifteen feet high, with light, looking woods back and still further behind that hills of perhaps 800 feet in height. At Esashi two small reefs came to view; the the first of hard trachytic porphyry, with dark-gray paste and some sanidin and many iron rusty-looking blotches that gave a mottled brown and gray appearance to the rock, but without any clear dip. The other reef, a few yards beyond, had a course of S. 50 degrees W.

Esashi turned out to be but a small village of a dozen

Aino houses and a comfortable hotel. The respectful politeness of the place seemed to go beyond anything we had met with, even in the numerous other very polite places we had visited. As the day's journey had been short, we had leisure to do some office work afterwards.

On the 22nd of September we rode from Esashi to Shōnai, thirteen miles and three-quarters ($5\frac{1}{2}$ ri) with a somewhat more varied route, and too difficult, it was said, to permit of going a second stage the same day. All but the last ri or so, to be sure, was over much the same ground, on a beach alongside of flat land five to twenty and, towards the end, fifty feet high, crossing at times small rocky headlands, but with a range of wooded hills, a couple of hundred feet high at first and perhaps five or six hundred feet high at the further end, running northeasterly and so coming nearer the shore as we advanced until we passed around its end. Then on its northwest side, after passing a valley, we came to another equally high, or higher, parallel mountain with high cliffs along the shore end, so that we had to climb by a very bad road a couple of hundred feet high over its slopes and descend on the northwest side to the hotel and four Aino houses that make up the village of Shōnai.

Within a quarter of a mile of Esashi hotel there were some wide reefs of rock that had been cut down level by the sea. The rock at the nearest point was a dark-gray trachytic porphyry with much sanidin and some hornblende, almost a syenite, with a dip of 45 degrees N. 55 degrees E. There is also a cleavage plane less common and less regular, dipping 70 degrees S. 35 degrees E. A few yards beyond, the strike is seen to curve round, and the dip becomes 80 degrees N. 35 degrees E.; the rock here also is a light-gray syenite, greenish when wet. A couple of hundred yards further on there are reefs with a strike of N. 30 degrees to 50 degrees E. Within an-

other couple of hundred yards is a broad and long reef of rock like the first, with a dip of 70 degrees S. 45 degrees E. Half a ri beyond is another reef of green trachytic porphyry with sanidin crystals and imperfect ones of hornblende and with a dip of 70 degrees N. 60 degrees E., bending round, however, within some thirty yards to N. 80 degrees E., about 80 degrees steep. A quarter of a mile further on there was a cliff of dark-gray trachytic porphyry with sanidin and a very little hornblende and with a dip of 75 degrees S. 45 degrees E. Another quarter of a mile further on was a reef with a dip N. 45 degrees W. about 45 degrees steep; and a little beyond, a reef with the course N. 50 degrees E., made up of pink trachytic prophyry with small hornblende crystals, the rest fine grained. A few yards beyond, the dip was 75 degrees S. 30 degrees E. A quarter of a mile more brought us to a small, rocky headland, apparently of dark gray trachytic prophyry with a strike of N. 50 degrees E. On the other side of the headland the reefs were almost continuous for some hundreds of yards, with strikes, successively, of N. about 45 degrees E., N. about 60 degrees E., N. about 50 degrees E., N. about 40 degrees E. (dip about 45 degrees northwesterly), and and again N. about 45 degrees E. (apparently a buff weathered trachytic porphyry). Then after a gap of a few hundred yards, followed a reef with a strike of N. about 50 degrees E. Then, in a couple of hundred yards more, there was a small headland of dark gray trachytic porphyry, and on the other side a reef with a course of N. about 40 degrees E., rather more than halfway just under the resting house,

A quarter of a mile beyond there was a reef with a dip of 30 degrees northwesterly, and a few yards beyond that one with a very clear dip of 45 degrees S 40 degrees E., the rock a very dark, coarsely-granular, trachytic porphyry,

with sanidin. Then after a mile, or less of crossing a headland, there was under the first mountain at an Aino village of four or five houses, a reef of rock like the first of the morning, with a very clear dip of 40 degrees S. 40 degrees E.; and close beyond reefs with a strike of about N. 20 degrees E., ending in a low rocky point, apparently of dark-gray, trachytic porphyry. Beyond the point there was for several hundred yards another succession of reefs of apparently the same dark-gray trachytic porphyry, with strikes of N. 40 degrees E. (dip about 80 degrees south-westerly,) N. 50 degrees, 35 degrees, 30 degrees, 35 degrees, 20 degrees, 0 degrees E. (dips all about 90 degrees) N. 30 degrees E. (dip 70 degrees north-westerly), N. 30 degrees E. (dip 45 degrees north-westerly), and a few yards beyond another did about 30 degrees north-westerly. A saddle in the rocks had clearly just been passed, no doubt the same that forms the mountain ridge close by.

Then just across a small headland, we passed a little village of three or four Aino huts and a banya and storehouse, all at that time unoccupied. A couple of hundred yards beyond was a reef of green, compact, probably trachytic rock with calcite seams, and with a dip about vertical and strike of N. 30 degrees E. Then crossing a small rocky headland, we came in a few hundred yards to another reef of the same rock, and a couple of hundred yards beyond to a cliff of it with a dip of 60 degrees N. 75 degrees W. Across another small headland we found first green rock, and then close beyond reddish, compact, probably trachytic, rock, with a dip of 60 degrees N. 35 degrees W. A few hundred yards more brought us to the foot of the second mountain, which we had to climb to some height. The rocks along its foot were reddish, but the dip could not easily be seen. On coming down on the Shōnai side, and only a few

hundred yards from the hotel, we found by the roadside an exposure of greenish, compact, trachytic rock with a dip of 40 degrees S. 50 degrees E.. Along the shore beyond there were many blocks of the same rock, weathered red on the surface, and it is probably the same rock that formed the red blocks on the other side of the mountain.

In the afternoon we worked at our usual office work, report writing, copying, translating and map-making.

Hakodate, 23rd October.—On the 23rd of September we rode along the beach from Shonai to Sarubuts, about 21 miles (8.4 ri). There was not a single hill to climb; but the beach road was interrupted about half way by a ferry across a river that had a discharge of perhaps 200 cubic feet a second. The mountain of Shonai continued some hundreds of yards back from the shore, for a ri and a half or so, growing lower to only some 300 feet in height; after that there was nothing but a wide plain perhaps 10 feet above the level of the sea, at first open and grassy and, further on, lightly wooded with firs. The only rock exposures were some small ones on the beach and small reefs from half a ri to a ri distant from Shōnai. The first ones were of dark-gray, compact feldspar, crystalline, but of close texture, and in looks very much resembling limestone. The dip was 20 degrees W. A few yards beyond, similar feldspathic rock much resembling marble, partly white, dipped 50 degrees N. 45 degrees E. Again at a few score yards beyond, the same gray feldspar, but partly veined ribbon fashion with red, dipped about 65 degrees S. 70 degrees.

Within half a mile of Sarubuts we passed three or four Aino houses that seemed deserted; and with the exception of the Aino ferryman's house and and one Aino house at Sarubuts, we saw no other habitations.

In the afternoon we continued our office work as usual, copying, translating and mapping.

On the 24th of September we rode, still constantly on the sandy beach, from Sarubuts to Chietomai, 13¾ miles (5,5 ri); crossing soon by a ferry the river on the bank of which the Sarubuts hotel stands, a river of a discharge of perhaps two hundred cubic feet in a second. The country was flat but somewhat higher, say twenty-five feet above the sea level at first, gradually rising to fifty, seventy-five and at the end over a hundred feet in height.

The rocks to be seen were very few and all at one bend in the shore. About a ri from Sarubuts there was a small projecting ledge of greenish gray, rather fine-grained trachytic prophyry with sanidin and much greenish hornblende, almost a syenite. The dip was 60 degrees S. 65 degrees E. and a corresponding strike was given by the course of a small reef in the water. There was also a well marked cleavage, with a dip of 65 degrees S. 35 degrees W. About two hundred yards beyond there was a projecting thin rib of similar but more shaly rock, weathered brown, with a strike of N. 40 degrees E., and a dip about vertical. There was a long curved reef opposite in the water.

We had hoped to go to another stage the same day; but it began to rain about an hour before even I had reached Chietomai, and soon rained very hard, and it continued rainy through the day with only intervals of better weather. So we went no further, but occupied ourselves with our usual office work.

On the 25th of September the weather promised better at first, and we rode along the seashore still without climbing any hills from Chietomai to Sôya, at the very northern end of Yesso, 15 miles (6 ri). But the weather disappointed us, and the greater part of the way was travelled in the rain which fell much of the time very violently and continued to do so most of the day, accom-

panied by thunder and lightning. The night had been so clear and cold that we saw in the morning the first hoar frost of the season, so little, however, as apparently to do no serious harm to garden plants.

The land along the shore soon became very hilly as we advanced, rising to the height of perhaps 300 feet with very deep bluffs and even high cliffs along the seaside; but afterwards the bluffs became grassy, rounder and down to a hundred or seventy feet in height.

The rock exposures began hardly a quarter of a mile from Chietomai, with two small ones of gray, small-grained tufa made up of feldspar, quartz, a little hornblende and some minute pebbles of blackish quartzite, and with a dip of 30 degrees S. 35 degrees W. A few score yards beyond there was a ledge of gray, shaly, probably tufaceous sandrock, with a dip of 50 degrees S. 10 degrees E., the bed curving in a few yards so as to get a strike of N. 60 degrees E. A few more yards beyond, however, the strike became N. 80 degrees E. again, with a dip of 40 degrees S. 10 degrees E. The exposure was then almost continuous for many score yards, the rock changing to dark-gray shales, but probably still of tufaceous character. The strike became N. 4 degrees W., with a dip of 60 degrees south-westerly. Further on the same shales dipped 25 degrees N. 10 degrees W., a very clear dip. A few more score yards brought us to a dip of 5 degrees S. 60 degrees W.; and again a few score yards more to a strike of N. 40 degrees W. in the same shales. Yet a few score yards more led to an exposure of the former gray tufaceous sandrock, with a dip or (possibly a cleavage), of 60 degrees S. 15 degrees W., but a few yards beyond, a clear dip of about 45 degrees S. 70 degrees E.; and again a few score yards beyond, a dip of 10 degrees N. 50 degrees W. A few yards only beyond there was in a low cliff a very good clear dip of the same gray (rather greenish)

tufaceous sandrock with thin layers of the dark gray shales between, 15 degrees N. 30 degrees W. The dip continued in about the same direction many score yards but steepened to 30 degrees, the strike changing slightly, perhaps to N. 50 degrees E. A few score yards beyond the dip was, perhaps, 40 degrees N. 40 degrees W. Some hundreds of yard further on we saw an exposure of a tufa pebble rock, but with pebbles chiefly of metamorphic rocks, and with a dip of 15 degrees S. 60 degrees W. and a few yards beyond 45 degrees N. about 40 degrees W. a few yards again beyond that, the same pebble rock, with finer pebbles, dipped about 10 degrees and 15 degrees N. 80 degrees W.; and still a little further on some 30 degrees S. 70 degrees W. A few hundred yards more brought us to a cliff of very dark gray, or blueish, volcanic rock, probably trachytic porphyry, compact, with grains of greenish hornblende, and with dips of 20 degrees and 35 degrees N. 80 degrees W. That was just before reaching a village of half a dozen Aino houses and a banya, called 3 ri from Sôya. Just beyond, similar dark-gray volcanic rock dipped first about 45 degrees N. about 50 degrees W., then 20 degrees N. 80 degrees W., then 25 degrees N. 80 degrees W.; and a small island of roughly columnar rock, some 25 feet high close to the shore was passed. Beyond that no rocks were seen until some small exposures within half a mile or so of Soya. It seemed to be a hard, greenish-gray, tufaceous sand rock; with a dip of about 20 degrees northwesterly and further on, about 30 degrees northwesterly.

The land along the shore was mostly open and grassy, but further back there were light looking woods.

The village of Sôya looked much smaller even than that of Nemoro; but has a certain importance as the nearest Yesso port (a slightly sheltered roadstead) to Karafto (Sagalin). The two southern Capes of Karafto

are but a dozen ri (30 miles) distant from Sōya, and are said to be visible in good weather from the hill top though not from the shore. We hunted up a couple of Japanese merchants who had lived sometime in the southern part of Karafto, and they kindly answered our careful inquiries as to the nature of the rocks of that region, which they said were of the same kind as a stone they pointed to in the hotel yard. It was an old volcanic rock, a greenish gray trachytic porphyry, containing sanidin and brownish green amphibole (?) and empty cavities. They also told us that there was a very strong current in the strait between Yesso and Karafto and that it flowed south-easterly at high or rising tide, but south-westerly at ebb tide. The governor of Sôya spoke of the current simply as moving south-easterly towards Mombets, without distinguishing the reflux.

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On the 20th of September we rode from Sôya to Bakkaë nearly nine ri; but I, unlike the others, lengthened the trip to $27\frac{1}{2}$ miles (11 ri) by going round a promontory about six ri from Sôya, in order to see the rocks along the shore. They crossed by a high hill road, but without seeing there any rocks in place.

My road was very level all the way and almost always on a beach. For the first ri and a half there were bluffs and hills alongside, of perhaps seventy-five feet in height almost always open and grassy, and where any trees were to be seen, they were scattered and small. About midway of that distance were small exposures on the beach of a grey rock, apparently an impure lime rock, and nearly in place, but not quite so. Just beyond, however, the same rock appeared to be in place, with a vertical cleavage running N. 25 degrees W.; but the true strike seemed to be N. 40 degrees or 50 degrees E. though very obscure and the dip not clear. At

the end of the ri and a half there was a small river and a ferry, and on the near bank there were greenish shales in place, a small exposure, with a dip of 85 degrees N. 25 degrees W., and on the far bank a small exposure of the same shales and of the tufa pebble rock of the day before with a dip of 10 degrees N. 25 degrees W.

Beyond that the hills quickly disappeared entirely and the whole country was a low, flat plain, some ten feet above the sea, with a wide sandy beach at the edge. At the end of four ri from Soya there was another ferry across a stream "30 ken," 180 feet, wide; and hills of a hundred feet, or more, in height reappeared a quarter of a mile or so from the sea. They grew higher to a couple of hundred feet, and came nearer to the sea, until only a hundred yards or two distant at the neck of the peninsula which the main road crossed. Near that point there began a series of almost continuous exposures of rock that ran around the whole peninsula close to the edge of the narrow, stony beach at the foot of a low bank. The rock was a hard, greenish-gray, fine-grained, probably tufaceous, sandrock, most likely the same as the similar rock we had seen the day before; and perhaps the impure lime rock of the morning was but one variation of it. At the northern end of the peninsula the low plain at the foot of the hills was somewhat wider and reached perhaps 500 yards beyond the end of the hill, a space that is cut off by the road. There is said to be a long reef in continuation of the peninsula; but there is no cliff such as Matsura's map had led me to expect. In spite of the number and length of the exposures the dip was very difficult or impossible to make out satisfactorily, owing to the numerous cleavages and to the wearing of the waves, which made the surface of the rock slope towards the water, and not only the surface but thin fragments that were scaling off. It is most pro-

bable that the strike is about parallel to the general course of the promontory say N. 10 W. and the structure may be that of a saddle.

From the western side of the neck, there was a broad, flat beach, with bluffs and hills some seventy feet in height a short distance back, and not a rock exposure all the way to Bakkae. There was in the corner of the hotel yard there a little crag some eight feet high of the gray tufa pebble rock already seen this day and the day before, but with its pebbles of blackish quartzite reduced to the size of mustard seeds. The dip was very clear, 40 degrees S. 80 degrees W.

Bakkae seemed to be made up of the hotel and hardly half a dozen Aino houses; and the long beach we had just traversed was uninhabited. But around the shores of the promontory, especially on the eastern side, were several small villages of Japanese fishermen along with some Ainos. Between that and Sōya, too, there was a very small fishing village at the second ferry, besides a few scattered houses elsewhere.

All along the shore near Bakkae we had for many miles a fine view of the magnificent, symmetrical, nearly conical, high mountain Riishiri, a large island a dozen miles from the shore of Yesso, and also of its lower, more distant, and more nearly flat-topped companion island Rebunshiri ("shiri" in the Aino language means island). By what we could see and by information carefully sought at Bakkae and at Soya we became satisfied that the rocks of Riishiri were all whitish, recent volcanic rocks, probably like those we saw on the upper Ishcari and on the Otopchi; indeed we were told that the Riishiri mountain was still constantly smoking a little, though we saw nothing of it on the Yesso side. On the other hand, the rocks of Rebunshiri appear to be old volcanic rocks, probably tra-

clytic porphyry, of various colors, red, white and gray, "rough and dirty," harder than the rocks of Riishiri.

Very soon after starting the next morning (Sunday, 27th September), from Bakkae for Teshio, 32½ miles (13 ri), I took, by a vertical angle above the horizon, with the pocket sextant, the height of the top of both islands, and found Riishiri to be about 6,000 feet high and Rebunshiri about 1,700 feet high.

Within a quarter of a mile or so of Bakkaë we saw a large crag a couple of hundred yards back from the shore, evidently of the same rock as that of the honjin and with like dip. Near by, also, on the beach we passed some blocks of the same rock and small exposures of it in place with a dip 10 degrees S. 55 degrees W. and with some pebbles as large as an egg. That proved to be the last exposure of volcanic rock that we saw north of Rurumoppe, after seeing no other rocks all the way from Nemoro.

The rest of the ride to Teshio was, but for the beautiful view of Riishiri at our side for one half the way, rather uninteresting and monotonous. Nothing but a wide sand beach, flat and fine and hard at first, but afterwards a little steeper and coarser and looser and difficult for the horse with a low, sandy bluff a dozen feet high, bordering a wide, open, grassy plain with low hills the first half of the way, perhaps 150 feet in height, several hundred yards back, covered with light-looking woods, and with scarcely even a few small streams to cross. Half way we passed a solitary hotel, and here and there the ruins of a former resting house, but otherwise no dwellings. At length with my horse almost thoroughly exhausted we came to the Teshio river near its mouth, and crossed it by a ferry. It proved to be a stream of perhaps four hundred feet in width, and with the breeze we had was quite rough for the shallow flat boat. Then

half a ri or so, partly through low, flat, swampy ground, and partly over slightly higher lightly wooded upland brought us to the little village of Teshio, the capital of the province of the same name, which covers the whole northwestern end of the island.

The village is on the landward bank of a large bayou, a long distance from the river's mouth. The water in front of the village is said to be 20 feet deep, and it is separated from the sea by only a low (say five foot high) sand bar called about two "cho" (240 yards) wide. The water at the mouth of the river is only six or seven feet deep, they say. The place near the village would seem to be a very promising one for building an artificial harbor some time, in a region remarkably destitute of such advantages and at the mouth of a very large valley.

The village consists of the hotel, the government office, three Japanese houses and twenty-three Aino ones. In the fishing season there are forty men to each of the three Japanese dwellings and eighty to the hotel (living for the most part in huts) making 200 men in all. The only product of the place is salmon, of which 1,000 koku (say 10,000 riyos' worth) are taken yearly, mostly from the sea but partly from the river. That would give a return of fifty rios to each of the men employed, not deducting the government tax. Owing to the absence of rocks there is no seaweed, and no nishin (herring?)

We were told at Teshio that Mr. Ishibashi went up the river last year in search of the coal said to be found there; that he did not go above the mouth of the Ambeshinai river, estimated to be 33 ri from the mouth of the Teshio; that he reported finding beds of coal of poor quality (a sample was given us,) and of thickness quite unknown, about three ri below Ambeshinai, and four day's journey from Teshio, at a place which even the Ainos who accom-

panied him now say they do not know; that he found bits of coal further up the river but no bed in place. It seemed decidedly not worth while for us this season to go up the river such a distance on the strength of so imperfect and so far as it went, discouraging a knowledge of the merits and place of the coal.

We gained also some information in regard to the rocks of Teshiri and Yageshiri, small islands off the coast, a little further south, opposite Tomamai. The rocks were described as baked or roasted rocks, and seemed, in fact, to be old volcanic rocks, probably trachytic porphyry, mostly gray and dark-gray, but in some places red, as shown us on rough maps of the islands.

The next morning (28th Sept.) it was rainy, sometimes violently so, with thunder and lightning, and even in the afternoon it continued to be very threatening. We staid, therefore, at Teshio, and went on with our office work, namely, copying the report and mapping the Itashibeoni sulphur place and other mapping and translating.

On the 29th of September we rode from Teshio to Fuurebets 21 miles (8.4 ri). For about two-thirds of the way the road and the country was almost exactly the same as that of the latter part of the day before, a loose sandy beach with low, flat, open ground at the side, and some hundreds of yards back, light-looking woods, and afterwards low hills approaching the shore. One small river had to be crossed by a ferry, and required a little circuit inland. At the ferry were two Aino houses, the only dwellings we saw the whole way.

The last third of the road was quite different. The hills, perhaps 150 feet high, had here come to the sea shore and lined it with cliffs a hundred feet high. The rock was immediately recognized as the soft, greenish-gray sand rock of the Toshibets (Karafto) group, and at the beginning (northern end,) of

the exposure the dip was 50 degrees N. 70 degrees or 80 degrees W. Owing to the height of the waves that day, we had to leave the shore and take the hill road. A horrible road it proved to be, with many steep ascents and descents; and the ground was full of holes and cracks, half concealed sometimes by the weeds, so that the horse stepped into them, once up to his shoulder. The cliff along the shore too, had been thrown into great confusion at some points by breaking off and falling over in large masses. All these unusual appearances were said to have originated with a series of earthquake shocks that took place last spring, beginning the 28th of February, and lasting thirty days, with two or three shocks a day. Just along here was the most violently disturbed region, although the quaking was felt far and wide along the shore. You will see by the date that the earthquake began about three weeks after the eruption of Tarumai Volcano, and was not, therefore, so simultaneous with it as our informant in Sapporo last summer supposed. Probably there was no connection between the two things so far removed from one another (about 125 miles or 50 ri) without any earthquake at intermediate points, and there was probably a mere coincidence in respect of time, and that not a very close one either. Not only had the hill road suffered (which otherwise would have been very bad and seems not to have been in the least repaired for several years, although only a few hours' work would lessen its dangers very much), but the hotel at Fuurebets had been much shaken and a small adjoining building had been tumbled down. There is no village at Fuurebets, only the hotel for the accommodation of the few travellers who pass. It was surrounded on the windward sides by high double barricades of dried weeds, the first case we met with of what we found further south on the west coast to be a common practice for the protection of houses against the cold north-west winds which prevail in winter.

At Fuurebets and on some of the neighboring small streams the hillsides near the shore toward the streams were very clearly terraced at the heights, say of 40, 30, 25 and 15 feet. As the sea has been wearing away the shore, so that former valleys and hills are now cut across by the cliffs and beach, these terraces may have been formerly quite inland and purely river terraces, not sea terraces at all, no indication that the sea stood at these levels. My impression is that the terraces on the different streams did not correspond very closely in height.

The next day (30th September), the waves were such that we could pass along under the cliffs on the way from Fuurebets to Tomamai, 20 miles (8 ri). In some places, however, soon after starting, the small space between the cliff and the water was so encumbered with blocks of stone as to make the passage rather difficult; but after the first half ri or so the beach became wider and the riding easy.

The high cliffs of the same rock were almost continuous the whole way, but numerous small streams were crossed with low, flat ground for a few hundred yards on either side. About half a ri from Fuurebets the dip was 15 degrees N. 40 degrees E., and just beyond that there was immense cross bedding, with dips varying from 10 degrees to 45 degrees N. about 40 degrees E. About a ri from Fuurebets the dip was 20 degrees N. 30 degrees W. Then within a few yards the dip suddenly changed to only about 3 degrees north-easterly, and the rock became light-gray and then greenish clays and then brown gravel.

At 3 ri or so from Fuurebets the rock was again a greenish-gray, soft sand rock, and a large, much worn white fossil pecten 0.4 foot wide was found in one block together with some bits of lignite.

Halfway, we passed near the seashore a solitary hotel at a small stream called Chikubets. A few hundred

yards beyond that the soft, greenish-gray sand rock of the cliffs, with nearly level dip (it had been about 3 degrees south-westerly just before reaching Chikubets,) contained large numbers of very recent looking fossils, of which I gathered quite a number. They were very fragile, white and sometimes possessing still their pearly play of colors. A few hundred yards further on, there were numbers of the same shells apparently that had been washed out by the waves and were stronger. Among them were oyster shells which appeared to have come from the rock since the place was at present unfavorable for their growth.

A ri and a half or so north of Tomamai there was a ferry to cross, and a small Japanese village there and again a few hundred yards before reaching Tomamai some Japanese dwellings were passed ; the beginning of the Japanese population of southern Yesso, and the end of the long space we had traversed where almost the only Japanese houses were the hotels. Henceforth the coast was found to be lined with villages, pretty much as you have seen it still further south, with gaps here and there where a long, sandy beach interrupted the rocks and left no chance for nishin (herring ?) fishing. Tomamai itself, therefore, gave us the impression of quite a large village, with its long street of scattered houses at either end, They said there were, in all, eighty houses, including Aino houses and a dozen in the two islands opposite.

With the pocket sextant I found the height of these islands to be about 550 feet, for Teshiri, and 350 feet for Yageshiri.

The night of our arrival at Tomamai a heavy rain and wind storm set in, and continued on the 1st, 2nd and 3rd of October. We therefore staid at Tomamai, and occupied ourselves with report writing, copying and translating and with mapping. The 4th of October was, at first,

still rainy and doubtful, and as we should probably have to wait a little for the arrival of boats at Herashibets, where we were to go up the river in search of coal and where there was no good stopping place, and as it was Sunday, we staid still another day at Tomamai. The interpreter, however, went on when the weather had cleared, to Rurumoppe where he was to to stay during our river trip, and meanwhile was to hurry up our boats. On looking at Riishiri on the morning of the 4th, it was seen to be beautifully covered with snow for perhaps 2,000 feet down from the top. Also Ofuyudake near Rurumoppe had snow on its top for some distance down.

On the 5th of October we rode from Tomamai to Herashibetsubuto, 22½ miles (9 ri.) The almost continuous succession of house and gardens lasted from the hotel to a ferry, perhaps half a ri distant; a little flat land near the seashore and grassy bluffs and growing lower, from perhaps feet 250 feet to 80 feet high just back of the gardens; and light looking woods still further back.

Near the ferry we saw a temple which seemed to be shared by Booddhists and Shintôists, a "kongo," as it is called, an amicable arrangement that is paralellled in a certain town of Saxony where the Roman Catholics and Protestants worship in the same church, only separated by a grating. The Booddhist temples have been very rare in our circuit of the island, though there was one of moderate size at Tomamai. It seems natural that the gentle faith of Booddha should hardly feel at home among a people whose chief occupation is a kind of wholesale butchery. Shintô temples have been frequent, though often no larger than a bee hive.

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Yedo; 30th October.—The river at the ferry was some thirty yards wide, and was said to be thirty feet

deep; the distance from the sea, either by the river or straight across the low sand bar, was, perhaps, two hundred yards; the depth at the mouth of the river is said to be about four feet. It seemed to be quite a practicable place for a small artificial harbor, if needed at some future time.

After crossing the ferry and a low alluvial plain of half a ri or more in width, bordered by low sand hills (perhaps twenty feet high), towards the sea, we came again to hills along the sea shore; and they continued all the way to the Herashibets with a height of perhaps 150 feet at first and afterwards 100 feet, commonly a few hundred yards back and covered with low vegetation, but here and there coming close to a narrow beach, and exposing the rock in cliffs. Now and then a small valley cutting through the hills showed that the country behind had very light-looking woods. Between the hills and the sea was almost one continuous village of Japanese houses until the boundary of the Rurumoppe district was reached, and from that point onward the beach was wider and there was scarcely a single Japanese house.

At the village of Chashi there was a cliff of soft, green sand rock like that of the Toshibets group but containing small (nut size) lumps and thin seams of lignite in part brightly shining like bituminous coal, but not wholly so, as it seemed. At least one bed, however, of two feet in thickness was a coarse, pea-size, blackish pebble rock, with pebbles of dark quartzite. The dip was 65 degrees N. 50 degrees W. Opposite, in the sea, a few score yards from shore, and parallel to it, are rocky reefs and one sharp, narrow rock, some 25 feet high. The cliffs continue from ten to fifty feet high for some hundreds of yards, and at the next hollow the dip is 40 degrees N. 45 degrees W., the rocks the same, with one rib of egg size pebble rock, holding black, green and

white pebbles. Beyond the hollow the cliffs reappear, and ledges reach across the beach showing strikes of S. 45 degrees W., and dips of 45 degrees northwesterly. The rock is the same green sand rock. Then the cliffs become low (six feet) and thereafter disappear altogether. At the next brook (Charaseushinai) the dip is southeasterly; and is so also near the boundary of Rurumoppe district. About a mile and a half from the Herashibets low cliffs of green sandrock appear once more in the hill side, and in few hundred yards reach their greatest size in a (75 foot) high cliff that projects into the sea. The dips of several beds are very clear and are 40 degrees N. 50 degrees W. Several beds are exposed as follows, from above downward:

Pebble rock; pebbles, filbert size of blackish, porous, lava like rock and of white feldspathic rock, ...	perhaps	30 feet.
Pale blue or greenish-gray soft sand rock with pebbles	„	20 „
Soft sand rock and shales weathering brown and yellow	„	20 „
Greenish-gray soft sand rock	„	10 „
Coarse gray pebble rock with numerous *fossils*	„	10 „
Greenish-gray sand rock, weathering brown, with ribs of harder greenish-gray sand rock	„	30 „
		120

The numerous fossils were chiefly casts of shells with a few shells; one of them, imperfectly exposed, seemed to be a large pecten like the one seen on the 30th of September north of Tomamai in what appeared to be, unmistakably, rocks of the Toshibets group.

A few score yards beyond the high cliff brought us to

ledges of rock with a dip about vertical and a strike of S. 25 degrees W., and a few hundred more to a high cliff again with a rock of large pebbles, weathering brown, with a strike of S. 60 degrees E. and a dip of 25 degrees south-westerly. A few score yards beyond, at the mouth of the Herashibets, was a cliff with a strike of N. 10 degrees E. and a dip of 70 degrees easterly. All the rocks seen during the day were plainly of the same group, and seemed at the time to be of the Toshibets group in spite of the bits of coal and the north-easterly strike; but a careful comparison of the fossils will probably decide the question beyond a doubt.

We crossed the stream by a ferry a few hundred yards above the mouth, and stopped for the night at the small house of the ferryman.

Yedo; 31st October.—Near by on the sea shore I took roughly with the pocket sextant the height of Ofuyudake, about 6,000 feet, and of a high peak between Mount Mashike and the sea, about 4,000 feet. There was much snow on Ofuyudake, but apparently less than on Riishiri, which had seemed to be of the same height. Ofuyudake seems to be the mountain marked Shokambetsunobori on Matsura's map.

On the 6th of October Mr. Akiyama and I, with a cook and cooly, and no other servants, and with as little baggage as possible, started up the Herashibets in three small boats manned, alltogether, by seven Japanese and one Aino who was also the guide. We went to look at the coal said to have been worked on that stream seven ri from the mouth in 1866 and 1871.

The first day we succeeded by hard work in going about three-sevenths of the whole distance, say three ri, in a very crooked, but on the whole east-north-easterly, course. The river at first was, perhaps, 150 feet wide, but gradually grew narrower within the first ri to some

60 feet, a width which it retained, with slight variations, all the rest of the way to the coal. The country on either side of the river all day was commonly flat and but a dozen or twenty feet high above the river, but here and there some low hills rose on one side or the other, to a height of 100 feet, 150 feet, even sometimes 200 feet. They and most of the plains were covered with woods that looked in general very thin and light, with here and there some heavy sticks and a great deal of mere brush.

About half a ri above the ferry we found in the bank on our right at the foot of a hill a low cliff of soft, greenish gray sand rock and gray shales, containing many fossil-shells, among others a few oyster shells; also some bits and small seams of shining bituminous coal and a few small ironstone balls, full of casts of shells. The coal streaks seemed not to be of secondary origin, that is seemed to have been deposited as plants at the time the materials of the rock were first laid down. The dip was 60 degrees N. 25 W.

A couple of hundred yards below the mouth of Okennai, a branch stream on our right with a discharge of perhaps 80 cubic feet in a second, there were reefs in the river of greenish-gray sand rock or mustard seed pebble rock with larger (nut size) pebbles here and there. The dip was very clear, 60 degrees S. 80 degrees W., and the strike very straight, N. 10 degrees W. There were no fossils, but the rocks seemed clearly to belong to the same group as those at the last mentioned place.

Towards night fall we pitched our small tents on a pebbly beach, and the boatmen built themselves a lodge with poles and mats,

Yedo, 1st Nov.—The next morning (7 Oct.) we found there was a heavy white frost, and the thermometer as we started at seven o'clock stood at 42 degrees F., never-

theless the boatmen did not seem in the least to mind wading naked in the water whenever the boat ran aground. The river had become pretty shallow and the boats were commonly poled along, instead of rowing, and in many places they had to be pulled by main force over shallow spots or over drift wood. The boatmen were for the most part quite unskilled in river boating, and we had hardly gone half a ri this morning before one of the boats was upset or sunk in a rapid.

In spite of all such obstacles and delays we succeeded in going about three ri before night, in a general east-north-easterly direction, but by a very crooked course. The country was somewhat hillier than the day before, but still there were never hills on both sides at the same time. Their height, too, was not great; some 100 feet, 50 feet, 30 feet, and at the end of the day perhaps 200 feet. The woods in some places were rather heavier on the uplands, but even yet not very large.

A few score yards from the last night's camp we passed, on our right, small ledges of greenish-gray sand rock with, at the lower ones, a dip about vertical and a north and south strike; a few hundred yards further on a strike of N. about 10 degrees W., and a dip of 45 degrees westerly, and just beyond that a small, cliffy point of greenish-gray, coarse, soft sand rock with a very clear dip of 25 degrees S. 70 degrees W. The rock contained well marked, rounded pebbles of coals, as well as thin layers of coal that seemed to have been formed by the laying down of vegetable matter at the same time with the sand of which the rock was formed. The coal pebbles, however, certainly looked as if they had come from a bed of solid, fully formed coal already existing at that time. Half a mile or so further up stream, but owing to a great bend in the river, really but a few hundred yards distant, similar rock was found in place with a dip about level

and close by with a dip of 30 degrees N. 80 degrees E.; and here also were small, rounded bits of coal and some little streaks of coal besides; moreover a few iron stone balls about 0.2 foot thick. About the end of the second mile, and half a mile or so below the mouth of Otoitsukuchi brook, a small branch on our left, there was a ledge of greenish-gray sandrock with a dip of some 50 degrees westerly.

For a long distance after that, no rocks were to be seen but somewhat more than half a ri below the end of the day's journey there was an exposure of greenish-gray soft sandrock and of dark shales, with a clear dip of 70 degrees S. 20 degrees E. There were also two or three irregular, lenticular layers, up to one foot in thickness, of poor looking iron stone. A quarter of a mile or so further up stream there was a ledge of greenish-gray soft sandrock and gray, pea-size pebble rock, with a dip of some 60 degrees southwesterly and a strike of N. 55 degrees or 60 degrees W. A few score yards further up stream the same sandrock and dark shales, in part almost black, formed a long ledge with a dip of 60 degrees southwesterly and a clear strike of N. 55 degrees W., containing several seams of bright coal about 0.02 foot thick, thick, apparently genuine original seams; also a few heavy ironstone balls 0,2 foot thick, or less, and thinly scattered. At the upper end of the ledge the dip was 55 degrees S. 50 degrees W. A few score yards below the point where we camped for the night there was a ledge of greenish-gray, soft sand rock, with streaks of coal a hundredth of a foot thick that seemed quite genuine and not of secondary character, although accompanied by slightly rounded pebbles of coal; the dip was plain, 60 degrees S. 45 degrees W.

The night was clear and cold and in the morning (8th September) we found a very heavy white frost, the

heaviest yet; and the thermometer at the time of starting, about seven o'clock, was at 36 degrees Fahrenheit. Even at that temperature the boatmen did not hesitate to wade in the water; though for my part in my daily bath at the end of the day, the river was so cold as to be almost intolerable.

Within half a mile or so we came to a ledge of greenish-gray sand rock and shales with a dip of 60 degrees S. 30 degrees W.; there were here also some streaks of coal, a hundredth of a foot thick, that seemed genuine original coal seams. A quarter of a mile or so further up stream we came to the lowermost place where coal had been worked. At the river's edge was a ledge of greenish gray sandrock with a dip of 60 degrees S. 25 degrees W. The coal had been dug in the hillside about thirty five feet above and a drift or slope, some ten feet long it is said, had been driven in upon it, but was now fallen in so as to be quite inaccessible. The work was done, they said, in 1866, and abandoned the same year, because only little coal was found. One hearsay story, however, was that the coal was about four feet and a half thick. Some bits of coal, mostly very small, were lying on the ground below the mine, and looked good enough in quality, brightly shining bituminous coal.

A quarter of mile or so further up stream, at a small branch on our right at the foot of a hill some 60 feet high, we left two of the boats and all of the loads and with one light boat went on to the upper coal place through a country still much the same as the day before, but rather hillier; the hills rising to a height of 200 feet and at last perhaps of 400 feet.

A half a mile or so from the boats left behind brought us to a small ledge of greenish gray sand rock with apparently a steep south-easterly dip; and a few hundred yards more to a large ledge of the same rock with a dip

of some 20 degrees S. some 40 degrees W. A couple of hundred yards further up stream there was a low ledge of the same greenish-gray sand rock and of dark shales with a dip of 80 degrees S. 50 degrees E. and with at least one bit of coal, perhaps a single plant. Still a couple of hundred yards more brought us to the lower part of the upper or main coal place of the Herashibets. At the lower end of a long ledge of rock there was a layer of poor limy ironstone, 1,3 feet thick apparently with small fossils; a few feet up stream from that there were two thin lenticular, extremely irregular, crushed seams of of coal, the lower 0,3 foot thick, at most, the upper 0,6 foot, separated by about four feet of greenish-gray sand rock shales. Close about that there are two or three extremely abrupt changes of dip, perhaps from extreme cross bedding. The dips are for example, 65 degrees S. 10 degress E, 70 degrees S. 10 degrees W. and again 70 degrees S. 10 degrees W. At the last point there is the following section downwards:—

Greenish-gray sand rock, mostly soft, with one or two harder ribs exposed some...	20.00
Coal...	1.00
Blackish soft clay	0.40
Black soft shales...	0.20
Coal	0.65
Hidden	1.00
Dark-gray soft shales...	0.70
Black soft shales...	0.05
Light-gray soft shales	2.00
Black soft shales...	2.20
Light-gray shales, with a few lime-stone or ironstone balls, say 0.5 foot thick, irregularly scattered	3.60
Very dark blackish-gray shales..	1.00
Black shales, crushed...	0.70

Poor crushed (and slaty ?) COAL	0.80
Black soft clay	0.10
COAL	0.40
Hidden	0.10
COAL	1.00
Black soft shale	0.50
Crushed coal	0.20
Hidden	0.60
COAL	0.55
Black soft shale	0.10
COAL	1.15
	39.00

The whole thickness of coal in the lower part of the section, then, is 4.10 feet within a whole thickness of 5.60 feet but these coal seams are all very irregular in thickness and mostly very poor as to quality, and seem to be on the whole very decidedly not workable. The upper or middle part of them was dug into in 1871, and some of the coal was sent to the seashore, but the working was abandoned the same year and a few tons remain on the river bank just over the exposure.

For the next two hundred yards up stream there is an almost continuous ledge of rocks, and near the upper end is the main coal just above a very sharp basin-like fold (synclinal). On the lower (down stream) side of the fold the dip is 45 degrees S. 20 degrees E.; just above, it is about vertical, with a strike of S. 45 degrees E. The coal at this point is seven feet thick, but is plainly much increased in thickness by the peculiar position, just at the sharp fold where also the other rocks are all crushed together in great confusion. The coal bed disappears in the river bed close by the thickest point and in the other direction grows thinner and within a few feet (such is the confused condition of the beds of rocks,) splits into

two portions, forming a letter wye (Y), and the branches, after growing thinner to four feet on one side and 1.8 feet on the other, both come within a few feet more to an abrupt end. On the down stream side of the fold no coal is found short of the coal of the section just given, which, therefore may possibly be the same. But it is still more likely that the main bed is of less extent than that and thins out completely before reaching the point where it should reappear on that side of the fold. It is very clear that such a bed of coal, thick enough and good enough in one spot, to be sure, but of so little extent, is quite unworkable. Some digging was done upon it in 1871, but the labour of stripping off the alluvial earth of the river bank that covered it was too great and the enterprise was given up the same year. A pile of perhaps a hundred tons is still left on the bank close by.

The coal bed had no appearance whatever of having been formed as a secondary deposit from pre-existing coal. It was in long, continuous layers that conformed to the overlying and underlying rocks; and that had no appearance as if made up of pebbles of coal.

The main coal if seven ri by the windings of the river from the sea, was in a straight line just about three ri from the mouth of the river in a direction nearly due East. Its height above the sea was perhaps not more than a hundred feet; but the aneroid, owing to change in the weather, was not very exact.

It was useless to spend more time in searching for workable Coal in so very unpromising a place, and as soon as we had lunched we set out on our return down stream. Our progress was much more rapid than in going up, and we camped at night near the place where we had lunched the day before, about three ri below the main coal.

Just before camping we saw a large black bear scramble up the steep river bank some fifty yards before us. At the top it stopped and looked at us boldly, or else at the dog that was coming after it across the river, but our Aino, a renowned bear hunter, beat the side of the boat with his oar, and the bear took flight. The dog was recalled by a low whistle. It seems rather curious that even in Japan where so very many customs have originated quite independently of western countries, the whistle is appropriated to the dog and the cluck to the horse, just as in the rest of the world.

It was interesting to see how naturally the Aino took command of the young Japanese boatmen, who were mostly quite inexperienced in river boating. Never indeed in Yesso have I been able to see the least jealousy or hatred between the Ainos and Japanese.

The next morning (9th October) we kept on our way down stream and reached the ferry (4 ri) by the mouth again very soon after noon. On our way we had leisure to admire the beautiful colors of the autumn leaves just about in their prime and very brilliant. The first changing of color had begun to be slightly noticeable as far back as Mombets, the 16th of September.

Our horses were waiting for us at the ferry and we set out at once for Rurumoppe, five miles (2 ri) distant After leaving the half-mile wide flat near the ferry, the road lay along the seashore with rounded hills of perhaps 100 feet in height and afterwards rather less until a few hundred yards short of the town a low flat was reached. About half-way, there was a village of many houses.

Near the beginning of the hills there was a small cliff of greenish-gray sand rock with a dip of some 70 degrees S. some 10 degrees W. Likewise, near the end of the hills

there was some greenish-gray sand rock exposed in the hillside with a dip of perhaps 10 degrees north-easterly.

Yedo ; 2nd November—The same evening at dusk we went to look at the drawing of the salmon net on the beach opposite the hotel. The number of fish caught happened to be small, only a couple of hundred ; it was not one of the lucky times when 6,000 fish, or a hundred koku, are taken at once. The net had been formed into a sack and was just coming to land at our arrival on the beach. It was hauled along with difficulty by a few men on the shore and a dozen young men stripped to their waist cloth in the water. A large number of the townspeople, young and old stood looking on, and among them half a dozen or more of Aino women. A shallow bin had been formed close to the water's edge by coarse mats spread on the ground and planks set on edge parallel to the shore line. As soon as the net had been brought to the side of the bin, the men began taking out the huge fishes in their hands and throwing them into it. At the same time a number of flaring torches of bundles of bamboo dried with the leaves on, were held aloft by young men, lighting up a very animated scene. The fishes were seized by the Aino women, opened and gutted (without cutting off the head), and thrown down on the mats above the bin ; were then loaded by the hands of young men or by the hooked staff carried by well-to do more elderly men into creels upon the backs of women and so carried to the door of a store-house a few yards distant ; were there thrown on the mats of another shallow bin, and were thrown from that into the house by the hands of two young men who counted them at the same time with a loud chant ; finally in the house the salmon were rubbed and sprinkled liberally inside with coarse brown salt and piled up criss-cross in a great stack with a layer of the same salt an inch or two thick

between every two layers of fish. The building would hold some 1,500 koku of fish; and was to be emptied from time to time as junks sailed for Yedo with the salmon and salt in the same condition as we saw them. The whole business was transacted so promptly that at the beginning it was scarcely three minutes from the time when a fish was struggling in the sea until he had taken his place in the pile in the house. The spectacle was not uninteresting, but was no less digusting than most of the steps by which animals in general are converted into human food. The women, however, who played the part of butchers seemed to be impressed with no resemblance to themselves in their cousins the fishes, no more than in their doubly distant cousins the vegetables. As for cleanliness the fishes had not a single dip into water either during or after the operations upon them.

Among the salmon were a few with a hooked nose such as the river fishes have, and they were set apart for home consumption; as in like manner were a few fishes of other kinds. Among the rest was a large sunfish, as it seemed to me, prized for its oil.

As we inspected the work some of the more important overseers recognizing my excellent companion Mr. Akiyama came and greeted him with respectful and pleased faces; for he was governor of the district of Rurumoppe only a few years ago. We, his companions, of course did not fail to joke him on his fallen grandeur, but without succeeding in disconcerting his constant good humor. I did not after all discover the cause for which he had been removed from his office. It is not to be supposed to be sure that a wise and fatherly Government would discourage good behavior by such a reward; still even the wisest sometimes through misinformation or otherwise may make a mistake, and I hardly believe that the district can possibly have found

since his time a more gentlemanly, honorable and efficient governor.

The village of Rurumoppe itself was not very large though the district was very populous compared with what we had seen further north.

In consequence of rain in the night and threatening appearances the next morning (10 Oct.) we started rather late, but rode, in spite of a little rain on the way, 10¼ miles (4.1 ri) to Mashike (at the place marked Pontomari on Matsura's map,) the furthest point we could reach that day at any rate, on account of the long, difficult stage beyond. As they were just building a new bridge at Rurumoppe we had to cross the river in small boats. Immediately thereafter we crossed a small headland, perhaps half a mile across and fifty feet high.

Yedo; 3rd November.—On coming down to the sea again we found towards the end of the head exposures of rock in cliffs, ledges, reefs and islands. The ledge near the end of the point was a very dark-gray, very hard, compact, fine-grained, trachytic porphyry with very small crystals of sanidin (or at least transparent feldspar) and small yellowish-brown and green grains (of pyroxene?). The rock weathers with small holes on the surface; is somewhat columnar; and the dip is 50 degrees N. 30 degrees W. On the small islands opposite, of some ten feet in height, the rock is even blackish and very columnar. A score of yards or more south-easterly, the rock is the same; but columnar and with a very obscure dip; and is much besprinkled with a white radiated mineral that looked like aragonite, mostly in very small specks.

A ri or so of sandy beach bordered by bluffs of perhaps 50 feet in height, which were covered with grass and bamboo and had a nearly level top, brought us to some cliffs perhaps 30 feet high of soft greenish gray sand

rock with a dip of some 3 degrees N. 30 degrees E. or else about level. A few yards further on, the dip was perhaps 3 degrees N. possibly 50 degrees W.; and still a few yards beyond, it was 10 degrees N. about 80 degrees W.

The rest of the way to Mashike the road was along the shore with bluffs and hills of irregular shape, perhaps 100 to 150 feet in height, from a few yards to a couple of hundred yards distant, generally grassy but with a few trees to be seen far back. There were houses almost all along wherever there was space for them.

Here and there a small exposure of rock was to be seen, always greenish-gray soft sand rock, apparently of the Toshibets group and generally with a nearly level dip. A few hundred yards beyond the last mentioned cliffs the dip was some 5 degrees north-easterly (?); a few hundred yards further on 10 degrees S. some 60 degrees W.; a few score yards beyond that the same rock, but no dip was clear; a few hundred yards again, the same rock without any clear dip; a few score yards further, great sloping cliffs, perhaps 150 feet high, of the same rock with a dip about level. A few hundred yards further on we crossed by a bridge the Nubusha, a river of a discharge of perhaps a hundred cubic feet in a second. It is said that Matsura crossed by this river and by the Uriu river in four days to the Ischari river (or from the Ishcari to the sea); and that some bits of coal have been found near the head of the Nubusha but no bed of coal. A few hundred yards before reaching Mashike we passed under a cliff of greenish-gray soft sand rock perhaps 90 feet high with a dip of some 10 degrees north-easterly.

In the afternoon we were occupied with office work as usual.

Mashike seemed to be a village of some importance. It

was remarkable in our travels as the first place we had seen where there was a school, since we left Sapporo. The total lack of schools on the whole coast from Birô all the way round by Nemoro, Sôya, Teshio and Rurumoppe to Mashike seems to do hardly justice to the unusual love of learning that distinguishes the Japanese nor to the generosity of the government; but it must be borne in mind, as some palliation of the seeming neglect, that the Japanese population through the greater part of that distance is very thinly scattered, and especially that most of it is made up of mere summer visitants, laboring men without their families (perhaps partly owing to the lack of schools). Nevertheless the Aino population at some points, and even the Japanese, is quite enough to make at least primary schools very desirable. Schooling of course is one of the most important steps to be taken in the elevation and enlightenment of the Ainos; and the existence of good free schools would be one of the greatest attractions to Japanese immigrants. At the same time primary schools, the most essential of all, would cost so little, that they would plainly be among the most useful things for which the money intended for the opening up and settlement of the island could possibly be laid out. The improvement it would also work in the intelligence and character of the inhabitants would undoubtedly be very great, and lead to their increased skill in turning to account the various natural advantages of the new country which they inhabit.

Yedo; 5th November.—Mashike was very notable too for its hotel, perhaps the finest we had met with anywhere in Yesso; also for the curiosity of the inhabitants in regard to foreigners, a feeling that was probably the greater in consequence of the somewhat better education and intelligence of the place.

On the 11th of October in spite of threatening weather

we hastened on so as to cross the famous Mashike mountain before the road should be blocked up by snow. A bitterly cold strong wind not only made us very uncomfortable but by the high waves it raised, quite prevented us from going round the mountain by sea. We rode however to Hamamashike, 24 miles (9.6 ri).

The ascent did not begin until we had gone a ri or more along the same populous seashore with low hills on our left most of the way. We then went up a long ridge and rose pretty steadily to a height of some 2,300 feet above the sea; then still following the ridge had to descend and again climb two or three times heights of a couple of hundred feet, reaching at length to 2500 feet above the sea on the flank of a peak to our right that rose perhaps 500 feet higher. Then after another descent of a couple of hundred feet or more we rose again with occasional small descents until we had reached a height of about 3,800 feet above the sea, the highest point on the whole road.

Near that we found a couple of small exposures of rock in place without any clear dip. It seemed to be the same rock as had been exposed in loose blocks all along on the mountain, trachytic porphyry with a very dark gray, blackish paste and with numerous sanidin crystals and some brownish, crystalline grains, apparently partially decomposed greenish, not very black, hornblende, or possibly pyroxene. Those were the only exposures in place seen on the mountain except some not very large cliffs high up on the peak just mentioned.

From the highest summit we had to descend 700 feet to the crest of a dividing ridge only to remount to a height of 3, 700 feet above the sea, the very top of a peak opposite the real pass several hundred feet below, between us and the snowy Mt. Mashike on our left. There was a trace of snow even on the summit we passed, and

the thermometer was at 38 degrees F. a little before two o'clock in the afternoon, and a few snow flakes were falling. It was not at all too early in the season to get through with the crossing of the mountain.

The road henceforth descended very steadily and at first very steeply for a long distance, and then with the interruption of only a small ascent continued downwards even to the sea shore. Then by a very stony path, with blocks of old gray volcanic rock (probably trachytic porphyry) under bluffs of perhaps 60 feet in height, and afterwards of a hundred, passing two or three small valleys where there were hamlets or villages, at last the little village and hotel of Hamamashike were reached. As I had started about seven and had not stopped on the way for food or rest, I arrived soon after five o'clock; but the others, especially the baggage, did not came in until long after dark. Indeed this stage and the next (which they said would be still worse) are proverbial in the country for their badness. The road we had just gone over would be no disgrace to a community of goats or to the deer who probably laid it out for the most part, but to men with hands to throw away the loose stones and even without picks, shovels or the knowledge how to blast rocks, it would be far from creditable. After passing the highest point it was in many places almost impassable for horses even without loads; and the baggage had to be unloaded at times. No repairs on that side would appear to have been made within the past ten years at least, if ever. But the road is so barbarously laid out as to require thousands of feet of needless climbing; for it follows the crests of hills up and down and high above the real pass instead of winding along the hill sides until the pass is just crossed by a uniform easy grade. Of course in the earliest antiquity (when the road would seem to have been first adopted by men), without shovels a road could not have

been dug along the hillside and without powder a rock here and there could not have been removed by blasting. It is even possible that a well-engineered road might be carried round the seashore at a much lower level, above the cliffs there or perhaps even below them.

Above, say 3,000 feet in height, there were no woods except sometimes low brush and the five-leaved pine; the rest of the way on the mountain there were light woods.

The next day (12th October) was stormy at times all day, and we did not travel; but continued our office work, report-writing, translating and mapping.

On the 13th of October, however, after repacking some of our luggage for the greater convenience of the men who must carry it the whole distance because part of the road was too bad for horses, we set out on foot for Atsuta called 21¼ miles (8½ ri) distant. Perhaps, however, a scarcity of pack horses helped to make the master of the posting house insist that the baggage must be carried by men; for it turned out quite possible for it to be carried by horses at least the first half of the way and also the last third. The space that was quite impassable for loaded horses was in fact very short, and the more vexatious as a few hour's work of even the men that carried our baggage would have made the road more passable than the one across the Mashike pass. But in these parts men commonly travel by sea, and the roads are wholly neglected. Unfortunately for us the waves were too high to go round by water.

On leaving the hotel we passed by a very stormy road along the seashore under a bluff perhaps 75 feet high with high cliffs of very dark-gray, trachytic porphyry, in the form of a very coarse, tufa pudding-rock with blocks three feet through or more. A few steps further on there was in a rock a pebble of

white, trachytic porphyry with paste of pumice, or almost pumice, and with sanidin and a little hornblende.

A few hundred yards beyond that there was a village at the mouth of a river some thirty yards wide which we crossed by a ferry. Then half a mile or more along a low narrow sand bar brought us to the foot of bluffs again which rose above into a hill of 300 feet or more in height. But another half mile led to a small valley in which there was a little village and beyond which the hills came so close to the shore as by the cliffs to cut off progress there in the rough weather we had. So we had to climb the hill some hundreds of feet high. The cliffs were of dark-gray, trachytic porphyry, with much sanidin in small grains and many yellowish-brown grains of what seemed to be partially decomposed hornblende. The dip seemed to be about 80 degrees south.

On the hill road after passing a host of our baggage carriers I overtook my horse and had a short ride, the only relief of that kind until night fall. For on coming to the descent from the hill, though it was not impossible for the horse, it was so difficult and he was so slow that he was left far behind. The road wound about among the hills for some distance, but finally, within two or three miles, came down to the sea shore again at the mouth of a small valley with half-a-dozen houses.

Thence a foot path impassable for horses saved climbing the hill and passed under cliffs along a very stony shore. The rock was dark-gray trachytic porphyry with much sanidin and with hornblende and at one place for some distance a great deal of bright red or rosy glassy feldspar, as it seemed. The dip at one spot seemed to be perhaps 25 degrees N. 30 degrees E. A rocky point a few yards beyond gave the dip more clearly 50 degrees N. 30 degrees W. After passing a small hollow the

rocks were a very coarse (about two foot) tufa pudding-rock of dark gray trachytic porphyry with much sanidin.

Soon a larger hollow was reached with four or five houses, and from there it was necessary to climb over a hill to a height of perhaps 500 feet and descend in a smart shower to the hamlet and hotel of Gokibiru, about half-way from Hamamashike to Atsuta, it was said; and there we stopped to lunch and rest a little.

After as speedy a meal as vigorous expostulations could obtain we set out again soon after two o'clock to to cross the redoubtable Gokibiru pass, coupled in proverb with the Mashike Mountain road. Incorrect information at the hotel made out that I could ride no part of the way across the mountain, and so the horse had been led on before. The road quickly left the sea shore and climbed up at first gently, afterwards steeply, until the crest of a dividing ridge was reached. Then we passed along the crest going over summits of about 1,300, 1,500, 1,650 and 1,700 feet above the sea with hollows between, a few score feet lower. The ridge formed a large amphitheatre on our right opening on one side towards the sea, and on the other side joined to a dividing ridge which it was the main object of the road to cross and which formed with the amphitheatre a letter wye (Y), as you may say. At the crutch of the wye, two very fatiguing hours' walk from Gokibiru, we reached the highest point, not far below the top of a peak on our right and some distance above the real pass on our left. Thence we descended rapidly by a narrow valley containing here and there exposures of tufa pebble rock with pebbles of fist size and double that of dark-gray trachytic porphyry. The woods here as everywhere else through the day were only light. In that valley also were a few places in the road so completely out of repair that a horse could scarcely be led over them, yet capable of being easily made passable.

At length we left the valley and climbed over a nose of the hill to our left, and, after winding along the hillside for some distance, crossed a stream and kept down its left side until we came to a broad, comparatively gentle slope. Soon thereafter a steep zig-zag brought us to the seashore and a village, just after dark and four hours from Gokibiru.

The horse was waiting for me and, although I advised to no purpose that the others without horses should wait until morning before going on, I mounted to ride the remaining couple of ri, as it was called, to Atsuta, having no idea of the real nature of the road, supposing it to be along a beach, and even starting without a lantern. Beach indeed! The shore was covered with huge stones that made it almost impossible for a horse to go along; here and there a jetty built by the fishermen obliged us to go deep into the sea waves; often the road was so obscure as scarcely to be made out even with the lantern that we soon had to borrow from one of the houses that were scattered all the way. So we blundered along at a snail's pace, until about half-past eight we reached a village with a better road and crossed a river by a foot bridge some hundreds of yards above its mouth. Then we returned to the seashore and with a somewhat easier, in part sandy, road under high cliffs crept along until at ten o'clock we reached the hotel at Atsuta worn out with fatigue and exhausted with hunger. It was about midnight before we finally got to bed.

The next morning (14th October) on rising as usual at half-past five I was surprised to find that my faithful "boy" and the coolies who made the Ishcari trip with us had just arrived after having travelled through the night. They had come it seems in company with about a dozen of the baggage coolies who were late in crossing the mountain. Other coolies lay down for the night before getting to the seashore.

Yedo; 6th November.—The weather in the morning was rainy at first and we did not set out for Ishcari, about 11¼ miles (4½ ri), until afternoon, and even then it proved rainy. Meanwhile an amusing occurrence took place, a full account of which, if necessary, I reserve for a separate communication. It resulted in the interpreter's absenting himself from our party for a couple of days, and in the discontinuance of his translation, which I can therefore only give you in an imperfect state.

Almost immediately on leaving the hotel after crossing a rivulet we rode along the beach under cliffs again, first of perhaps 200 feet, then 50 feet and afterwards 75 feet in height made up of soft greenish-gray almost shaly sand rock with one or two hard bands like iron-stone about a foot thick. The dip near the beginning was 20 degrees S. 30 W. The rocks were evidently of the Toshibets group, and the same cliffs of it reached northward as far as the river we crossed about half-past eight the night before. Beyond that northward the rocks were no doubt the same old volcanic rocks we had seen on the mountain, probably dark-gray, trachytic porphyry.

For several hundred yards along the beach, about a ri or less after leaving Atsuta, we saw a number of pebbles that have attracted the attention of the neighborhood as ornamental stones. They are chalcedony that has been rounded and slightly polished by the surf. Most of these are white and translucent, but some are tinged of the color of iron rust by iron and are somewhat more opaque. They have not been found anywhere in the cliffs alongside and have been supposed to be "thrown up by the sea." Of course they are not formed out of sea water, and there is no special probability (though there is a possibility) that any bed of rock different from what is seen on the shore crops out under water and furnishes the pebbles. It is most likely that they come if not from the

greenish-gray sand rock, then from the alluvium which caps the cliff. They are not very numerous nor of much value, as the stone is not a rare one, but would if cut and polished make pretty buttons or seals; they are too small for paper weights.

At a point in the cliffs about a ri and a-half from Atsuta in the cracks of the rock about five feet above the sea with a dip of 10 degrees N. 40 degrees E., we saw some traces of rock oil, that have attracted much attention from passers by. There is however in all scarcely a spoonful of oil and it has no value or importance whatever except that it shows well the true source of the oil of Washinoki and the other places, which was at some points not altogether clear last year. The oil undoubtedly comes in all cases originally from the rocks of the Toshibets group, though sometimes it has entered the overlying alluvium and collected there. The certainty we now have on that point is an important guide, if the working of those small oil deposits is to be carried on.

A few hundred yards beyond the oil traces the cliffs came to an end and were followed by steep grassy bluffs of about the same height which likewise came to an end in several hundred yards more. There were light-looking woods some hundreds of yards back. Thenceforth as we rode along the broad, sandy beach all the way to Ishcari, we had on our left a wide open grassy plain hardly ten feet high above the sea, the lower end of the great alluvial plain of the Ishcari river. We passed two or three small fishing villages of some half a dozen houses each. Salmon is caught on such a sandy shore, but there are no nishin (herring?) nor seaweed.

On arriving at Ishcari, right bank, I looked once more at the warehouses and piers and dock built there two or three years ago. They had the appearance of being still

but little used if at all, and the dock is silted up so that there is bare ground at one corner. Of course the comparatively still water produced by the piers in such a place is highly favorable to silting up.

On crossing the ferry to the main village on the left bank we were pleased to find a decided improvement since last year. The number of new buildings, some of them quite large, showed plainly that the place was very prosperous.

The next day (15th October) after repacking some baggage and writing some business letters we rode along the coast from Ishcari to Otarunai, 23 miles (9.2 ri). The first two-thirds of the way, as far as Zenibako, was over low, nearly flat land with wind-blown, grassy sand ridges near the sea beach and with still lower, perhaps wet, land behind, and with stunted trees some hundreds of yards from the shore. From Zenibako to Otarunai the road lay almost all the way on the narrow space between the sea and bluffs of 60 to 200 feet high often high cliffs. About the beginning of the cliffs, a ri or so from Zenibako, the rock is a brecciated, dark-gray, trachytic porphyry with sanidin. Nearly opposite is a small rocky island with tufa pebble rock at bottom and very large pebbles or breccia at top and with a dip of 30 degrees N. about 50 degrees W. A few yards further on, the road passes through a small tunnel cut in the coarse tufa pebble rock of dark-gray trachytic porphyry with a great deal of sanidin; and, just beyond, there are very high cliffs and a pulpit rock apparently all of the same material. Bluffs, perhaps 125 feet high, very steep but grassy with here and there high cliffs of coarse tufa pudding rock of light-gray trachytic porphyry continued for a ri or so more, and then culminated (just half-way from Zenibako to Otarunai) in a height of perhaps 250 feet with very high and long cliffs of columnar volcanic rock, light-gray and

partly dark-gray trachytic porphyry with much sanidin and hornblende, and in the dark rock other dark yellowish-brown small crystalline grains, perhaps amphibole or possibly pyroxene. The dip as observed last year in June seemed to be gentle N. perhaps 60 degrees W., the reverse of what was noted about 200 yards towards Zenibako. The columns are about vertical and very irregular in cross section and lengthwise. Below those high cliffs there is an enormous talus of large blocks all the way to the sea and the road has to pass over them. From that place to Otarunai there are few or no good exposures of rock near the road; but bluffs continue with little interruption all the way, and are from 200 feet down to 60 feet in height. Just before reaching Otarunai the road passes over a hill of perhaps a hundred feet in height, and soon after reaching flat ground again and the outskirts of the town it passes a small isolated white rock a dozen feet high of pumice or what is nearly pumice but rather more compact.

Climbing over the hill just mentioned was lately avoided by a road built along the sea shore and a tunnel or two near the end of a rocky point; but the late heavy storm at the beginning of October, had torn the road to pieces so as to make it impassable. In many places, too, not far from Zenibako, the same storm had destroyed the road and made it almost impossible for horses to get along. Seven junks had at the same time been wrecked at Otarunai and some damage done to the houses of the town along the shore but already none of the mischief was noticeable to a passer-by except the wreck of a large junk at the water's edge.

Yedo; 7th Nov.—The next morning (16 Oct.) after finishing a letter to you and some other office work, I set out from the hotel; but soon left the sea shore and went in a boat to call on the captain of the steamer *Capron*, which happened to be in port, and to send you by him

the first 96 pages of this report along with their translation. Then on reaching shore again I rode to Rubeshibe by way of Yoichi, 30½ miles (12.2 ri) from Otarunai.

The road for a ri or so passes near the sea shore through the village of Otarunai and the adjoining Temiya and has commonly a bluff upon the left. Between the two villages the space for houses is narrow and little occupied, and there are some exposures of rock in small cliffs and little rocky islands just inside the water. The rock is light-gray, trachytic porphyry apparently, with sanidin and in places weathered on the surface into little pits. The dip at the first exposure met with was taken last year in June, 60 degrees S. 60 degrees W.; a hundred yards or so farther on, it was about 50 degrees S. 35 degrees W.; about 20 yards still further on, it was 35 degrees S. 45 degrees W., and about 20 yards beyond that and 100 yards short of the bounding brook between the villages the dip was 65 degrees N. 55 degrees E.

Yedo; 8th November.—The road after turning to the left from the seashore rose by a shallow valley to the top of a dividing ridge at a low point and then skirting the hill side to the right soon crossed the hollow to the left near its head, and passed over another dividing ridge and down into a deep narrow valley where there was a house by the road side. Then sideling up the opposite hill to the left another low pass in a dividing ridge was crossed; and the valley was entered by which with a long gentle descent a village on the sea shore was at length reached. The hills are gently rounded; and at one point a long gentle slop seaward is to be seen, apparently the comparatively rapidly descending slope of old alluvium of the bluff deposit mentioned in my report of last winter, not exactly a level terrace such as is found sometimes on the shore of the sea or of lakes or even of rivers.

After passing through the village and crossing a couple of small streams in it, the road went over a steep hill and quickly came down again to another village by the sea. Along the shore at the end of the hill, some 400 yards short of the village, are pale, greenish-gray cliffs perhaps 150 feet high close under the road on the sea shore. At the top, as noticed last year, is light-gray thin layered, probably tufaceous sand rock perhaps 25 feet thick ; below that, greenish-gray thin-layered probably tufaceous sand rock perhaps 20 feet ; then under that dark-brown, below almost black, no doubt tufaceous, very coarse pebble rock ; from that to the bottom of the cliff, light-gray, undoubtedly tufaceous, thin layered coarse pebble rock. The dip is about 30 degrees N. about 45 degrees W. Crossing a narrow valley we rose again to a hill top and winding round the head of two short seaward hollows descended again towards the village of Oshoro with its little harbor in sight, four ri from Otarunai and two ri from Yoichi. But instead of going to the village I turned off by a valley to the left which brought me by a single gentle descent to the next village on a sandy sea beach. Packhorses have to go to the post station at Oshoro, and thereby not only is the distance increased, but a couple of hills have to be crossed. Though not mounted on a post horse, I was taken twice through the village last year before I discovered the shorter road. The rocks at Oshoro as observed last year in June are greenish-gray, coarse pebble rocks, weathering slightly brown. The little harbour is a very pretty cave between a small narrow promontory on the east and a high hill on the west, the hill that has to be crossed on setting out for Yoichi.

On entering the village on the beach next to Oshoro, as already mentioned, a high cliff of greenish gray, probably tufaceous rock is seen to the right at the end of the

hill just spoken of. After traversing the village and a short sandy plain the road crosses a steep narrow hill with an artificial cut of some twenty feet in depth at the top, and comes down again at once nearly to the sea level alongside of cliffs of greenish-brown and greenish-gray very coarse, tufaceous pebble rock, with many large black pebbles and with a dip (June, 1873), of about 40 degrees S. about 35 degrees E. We had then but to ride over a low sandy grass covered plain close by the beach for about a ri to the ferry near the mouth of the Yoichi river.

A few hundred yards above the ferry but hidden from the road by low grassy sand hills are the two interesting farming villages of Kawahigashi and Kawanishi which we visited last year. They are in a fine alluvial plain that reaches back in a triangular shape a couple of miles from the sea, and contains therefore some 1600 acres. It is all unwooded like almost all the land we have seen between it and Otarunai; but is covered with high weeds and bamboo.

After crossing the ferry and turning to the right it was but a quarter of a mile round a high, rocky hill to the Yoichi hotel in a little hollow along with the small hospital, cut off from the main village just beyond by a narrow low cliffy point of volcanic rock. Last year in May and in June we found some obsidian in coarse pebble rock at the end of the point, and some of the obsidian had in it rows of imperfect probably feldspathic crystals. Some small portions of the rock looked like pearlite with pebbles smaller than peas. The dip was 75 degrees south-easterly with a strike apparently of S. 85 degrees W. Most of the rock would seem to be a gray trachytic porphyry.

We had planned staying at Yoichi over night owing to delays in the starting of the baggage in the morning;

but as I had learned on board the "Capron" steamer that the mail steamer was daily expected at Hakodate, I determined to push forward as rapidly as possible in hopes of catching it. Leaving word therefore that the rest should stay at Yoichi over night and overtake me next day at Iwanai, where they would have to wait at any rate until I could visit the Kayanoma mines, I lunched as quickly as possible and set out after two o'clock for Rubeshibe, six ri distant.

The road after passing for a half ri or so through the village left the seashore and going up a rather narrow valley with a large brook, at the end of another ri turned to the left again and climbed a hill, passing over two or three summits and finally the highest one about 350 feet high above the valley and perhaps 500 feet high above the sea, at two ri from Yoichi. Then descending a ravine we came in a few hundred yards near to the Yoichi river, and at a little distance from it kept along the foot of a steep hill side on our right. Near the beginning of the hill side there was exposed some shaly rock, perhaps tufaceous, of a pale greenish-gray color. Some hundreds of yards further on there were high narrow cliffs of gray, volcanic porphyry, apparently trachytic. A few hundred yards beyond that we crossed a pretty wide and long valley with a large brook, the Shikaribets, and passed a couple of houses perhaps both hotels, about 100 feet above the sea. Then we climbed to some height on a steep hillside close to the Yoichi River, and after descending and leaving it for a while came near to it again and by a very bad road passed over several hills until we finally left the river and bore off to the right, and gradually rising over rolling ground at last reached the solitary Rubeshibe hotel about half-past six, some time after dark; at a level of about 300 feet above the sea. Here and there were more or less imper-

fect exposures of volcanic rock, apparently still trachytic porphyry; but about half a ri short of the hotel there were some gray clayey shales in which we found some fossils last year in May. Soon after passing that point I was overtaken by my Japanese travelling companions who in spite of the directions left at Yoichi had ridden forward rapidly. The servants and baggage also toiled along, even after dark, until the horses on so bad a road refused to go further, and they stopped for the night a ri or two short of Rubeshibe.

The hotel keeper at Rubeshibe told me with a very intelligent and lively interest that a new road was to be opened in four or five days by which the distance from Yoichi would be only three ri, and "all level, not a single "hill;" and he showed a rough map with both roads on it. The new one goes up the right bank of the Yoichi river instead of the left and near the upper end crosses by a ferry. Near the lower end the road passes through the two farming villages already spoken of, and keeping back from the seashore reaches the cliffs at the eastern end of the long beach and plain in 3,55 ri, making the distance to Otarunai about eight ri, or 20 miles, instead of the twelve ri we had come. It will be possible then to cross from Iwanai to Otarunai in a single day. The improvement is a vast one and can scarcely be too highly commended. Perhaps many others of the old roads of Yesso with good engineering might be in like manner very much shortened as well as better graded. The saving thereby in the labor of travellers would in a year amount to a large sum, and go far towards making up for the expense of the work and possibly even exceed it.

The next morning (17 October) was very cool with a heavy white frost on the ground. We rode on to Iwanai, seven ri. The road following the crest of a narrow nose-like ridge climbed about a thousand feet in a mile and a-

half to the top of a pass in the main ridge, about 1300 feet above the sea, and then descended rapidly a narrow ravine. Some 300 yards from the top we noticed last year in May an outcrop of dark shales, probably tufaceous, much broken up by cleavages with a dip of 30 degrees S. 50 degrees W. (?). About 150 yards below that we found tufaceous, probably trachytic, greenish-gray pebble rock with pebbles of pea size, cropping out also at two or three points just beyond. As we descended, the valley grew wider and wider and less and less steep. After crossing the stream several times, and then a few low hills, we came out upon a wide open plain, which with some undulations and a gentle general descent lasted all the way to the outskirts of Iwanai on the seashore. The plain has the appearance of a fine place for farming, though perhaps a little dry in the midst of summer. Up to the beginning of the prairie the country had been wooded all the way from near Yoichi with generally rather light timber.

From Iwanai I went in the afternoon with a fresh horse to the Kayanoma coal mines ($3\frac{1}{2}$ ri) and back, to point out according to your instructions received at Otarunai the place where it would be best to begin a new drainage drift upon the main coal bed at the lowest water level. Owing to the absence of the map left in Yedo, and to imperfectness of recollection of the facts, it was impossible to point out the place with perfect certainty, but a promise was given to write more satisfactorily from Yedo after consulting the map again.

I found them sending coal from the mines to the sea shore, two miles, in mat bags on horseback, and a horse-path had been made for the purpose alongside of the two lower inclined planes. Such a practice was explained by the statement that ropes for the planes had failed to arrive from Yedo. The coal so expensively carried is, however,

in good lumps, less broken up than it formerly was in the two sets of cars used on the upper and lower railroads. I improved the opportunity also of visiting for verification a certain point on a hill where a mistake in the topography of the map had seemed possible. Also in passing Chatsunai I found by inquiry of half a dozen fishermen just pushing off in a boat that the bottom of that harbour and of Shibui harbour and of the space outside was really nothing but rock, as I had last year taken for granted, and that it was bad for anchors. The coarse, tufa, pebble rock there has black or very dark-gray pebbles of trachytic porphyry, with much of what seems to be sanidin weathered opaque white.

By good luck, therefore, there was nothing to detain us longer at Kayanoma. On returning to Iwanai at half-past six, I found the servants and baggage had all arrived; but quite late on account of the badness of the roads. The day's journey including the trip to the Kayanoma coal mines amounted to 35 miles (14 ri).

Yedo; 10th November.—The next morning (18th Oct.) after trying in vain to get from the post station a decent horse to ride across Raiden Mountain so as to relieve my own nearly worn-out one, I set out for Kuromatsunai 30 miles (12 ri) distant. The first ri was easy enough along the sea shore on a rough street lined with houses under a low bluff, the edge of a beautiful example of the bluff deposit. When looked at from a little distance the nearly flat ground above may be seen to slope very decidedly but uniformly from the mountains behind, especially from the mouths of gorges or narrow valleys in them, down to the sea, which has cut into it and left a bluff of varying height. There is no appearance as if the land above the the bluff had been the gentle beach-like slope of the bottom of the sea near land, and it cannot be called properly a sea terrace. Below the bluff, however,

is a narrow strip that is ten or fifteen feet high, above the sea and out of the reach of the waves except possibly in the very highest storms; and that may perhaps be a sea terrace. A similar one, perhaps a trifle higher and having a steep bank or cliff on the seaward side and exposures of rock, may be seen between Rurumoppe and Mashike, and seems necessarily to be a sea terrace, and to show that the land has been rising in comparatively recent times. The only other genuine terraces observed in Yesso were those mentioned last year near Idzumisawa (between Hakodate and Matsmai) and those near Fuurebets spoken of above; and they may possibly be the rare relics of sea terraces showing a rise of the land to a considerable height, a fact which would correspond well with the comparatively smooth outline of the present coast and the consequent rareness of harbours; but also may possibly be explained as lake or river terraces, as already described.

About the end of the first ri from Iwanai, the road leaves the seashore and climbs up the bluff and the gently rising land above to a height of about 200 feet, about half way between the sea and the mountains behind, then descends steeply and crosses a narrow deep ravine. Just above the place where the road crosses the small stream there is a cliff about eight feet high, and a hundred yards below, another about twenty feet high (as observed last year in June) of soft brown (probably sand-rock in layers about three feet thick, of very recent look and about level in dip. It belongs, most likely, to the Toshibets group of rocks.

The road then begins the serious climbing of Raiden mountain and rises pretty steadily and often very steeply keeping commonly on the ridge of a spur of the mountain until a height of about 240 feet above the sea is reached, far above the lowest point of a pass on our left.

At less than quarter that height we passed a small exposure of what seemed to be a greenish trachytic porphyry with sanidin and pores where perhaps hornblende was and with a dip (observed last year) of 10 degrees N. 60 degrees W, But possibly it was not in place; for a couple of yards forward is a mass of the same rock that is about level in dip and seems equally in place. About two ri from Iwanai and a couple of hundred yards short of a solitary house and temple by the roadside there is an exposure of bluish-gray trachytic porphyry with sanidin crystals and with a dip of 20 degrees N. 55 degrees W.

From the summit the road descended very rapidly to the Yunai hot sulphur springs at the bottom of a narrow ravine about 1100 feet above the sea, as taken with our barometers last year, and about three ri from Iwanai. From a quarter to three-quarters of a mile short of the springs along the road, there were large blocks of a vesicular rock with white rounded pebbles, perhaps of quartz, in a brown compact feldspathic paste; but none of them were in place. The springs and the unworkable gypsum a mile or so ("10 cho") up the ravine are mentioned in my report of last Christmas. Without stopping therefore at the nice little hotel I hurried on as fast as the rough steep road would permit, having to lead the horse a great part of the way, both for greater speed and in order to save him for the longer rides of the next two days. The road from Yunai to Oshamambe was new to me, while those from Ishcari to Yunai and Oshamambe to Hakodate had been passed over before, parts of them even three or four times.

The road rose rapidly to a height of about 1,950 feet above the sea, and then with some undulations to about 2,150 feet at a point from which there was a fine view of the lower part of the Shiribets valley with its broad, meandering stream of silver, as it seemed,

After that, the road descended very steadily and often steeply along the crest of a long nose of the mountain until the sea shore was reached, about two ri from Yunai. Close by the foot of the mountain there were, near the road, some small cliffs of greenish-gray, compact, hard trachytic porphyry with sanidin, dipping 30 degrees S. 70 degrees W. The road kept on across a grassy plain a few hundred yards back from the sea and separated from it by low wind blown sand hills of some fifteen feet in height, now covered with grass ; and in half a ri reached the bank of the Shiribets river, and a small village near its mouth. We crossed by a ferry and at once began to climb a steep hill to the height of about 300 feet above the sea; and then descended still more steeply by a narrow ravine to the seashore again passing on the way down an exposure of shaly, white sand rock (pale green when fresh) probably of the Toshibets group, with a dip about level. The road then lay along the sea shore below grassy bluffs of perhaps 50 feet in height, and was lined with houses almost all the way to Esoya, about a ri from the Shiribets. Several hundred yards, however, short of the village, the houses became at one point much fewer owing to the narrowness of the space for them left by the bluffs, and by low cliffs of the greenish-gray sand rock (with some harder brown ribs) of the Toshibets group.

By some singular arrangement the hotel (old honjin) of Esoya, although inhabited refused all entertainment for man or beast and pointed to a place some distance back, where no one had been waiting to receive us in the usual manner. But the road was long enough without turning back, and we passed on without refreshment. As far as Odashuts, a ri and a third, the road still kept along the seashore, often among houses, but often on ground too rocky or narrow for them, always

at the foot of bluffs or even cliffs. Here and there some hard ribs of volcanic rock, coarse tufa with pebbles half a foot thick of very dark-gray trachytic porphyry with sanidin, reached from the bluffs across the road into the sea, and formed there reefs near the shore. Between such ribs, however, there were some low cliffs of greenish-gray sand rock of the Toshibets group. Near Odashuts the hills retreated further from the shore and became high mountains; the widened space for houses was filled by a long village. Without testing the hospitality of the Odashuts hotel at so late an hour as the roughness of the roads had caused (half-past two), I rode on and in a few hundred yards reached the point where the road leaves the seashore near the head of a bay. The road then for a mile or two justified the previous expectation that it would be smooth, hard and free from stones, through a plain all the rest of the way, three or four ri. But what a disappointment was in store! After passing a small farming village the road became horribly bad, cut up into high transverse ridges with mire between, the result of the horses' habit of stepping in one another's tracks on soft ground. There was no improvement nor variation except for very short distances through miles and miles together, and the side paths that had been made alongside among the bushes were about as bad. Progress was extremely slow, and at half-past four the goal was still about two ri distant, when two tempting tea-houses were passed. It was already past six and dark when a large brook had to be forded; half an hour later a still larger stream close by the Kuromatsunai hotel. My two travelling companions did not arrive until somewhere about ten o'clock, and the servants and baggage not even then.

The valley we had come up from the sea was a wide open one, but with high hills some furlongs back on either

side. Before coming to the tea-houses we had passed near a mountain of perhaps 800 feet in height on our right. The road after that was hillier than before. The country was covered with thick bamboo along the road, and there were some high woods.

On rising about half-past five the next morning (19th Oct.) my surprise was very great to find that the servants and part of the baggage had arrived only a short time before, after travelling over those terrible roads all night; the second night lately that the faithful "boy" had gone through a like experience.

Yedo; 13th November.—Leaving the baggage and servants to follow as fast as they could, we rode forward to Yamukushinai, 38¾ miles (15½ ri). The first six ri, as far as Oshamambe, were in great part as bad as the road of the night before; except a ri or so of hard stony ground at the beginning, which my horse was too stiff and foot-sore to get much benefit from as regards speed. We succeeded, however, in arriving at Oshamambe on the shore of Volcano Bay by half-past twelve, after more than five hours and a-half of riding. About the end of the first ri we passed the highest point in the whole way across the neck of the great southern peninsula of Yesso, and it was only about 400 feet above the sea; and that seemed to be some distance above the lowest place in the dividing ridge. The road all the way was on the right side of the main valley and crossed many small side streams. Not until perhaps a ri and a-half short of Oshamambe did the road come close to the river of the same name, and scarcely within sight of it again. Both to the right and left at the distance of a few furlongs there were moderately high hills or even mountains in sight. The timber seemed everywhere to be light.

After lunching and seeing the horse well-fed and rested for two hours at Oshamambe, I rode on again, along the

good sea beach, remembering that part of the road from last year, and counting greatly upon it for speed. For nearly eight ri indeed, almost as far as Yurap, the horse accomplished two ri an hour.

At first we had bluffs of perhaps 75 feet in height a quarter of a mile back from the shore with a flat grassy plain below them and mountains 500 to 1,000 feet or more in height a quarter of a mile behind. The sand on the shore was in part white and coarse, and looked as if it came from syenite. At the end of three ri we crossed the Kunnui river with its little Aino village, opposite a pretty wide gap in the hills and mountains; and in another ri or so passed a few more Aino houses; but the long beach is little inhabited. The hills, perhaps 300 feet high, and the bluffs before them, still some 75 feet high, soon after that approached each other and the sea shore until both reached the beach at Kuroiwa (black rock), and were continued in some large blackish rocks that jut a hundred yards into the edge of the water and give the name to the little village and hotel a hundred yards beyond.

It was the only rock exposure in the whole day's ride, and I stopped a few minutes to look at it again. It is evidently the place which Mr. Blake in his report to you of April, 1872, mentions as Shiraika (Shirarika is just beyond), where he says there was "an outcrop of a black siliceous rock and of a sand stone totally different from it, and beyond, a dyke of amygdaloidal rock, lava like, in which are large agatized siliceous masses." The sand stone is light brown and horizontal in the bluffs here and for a few hundred yards beyond, and belongs probably to the Toshibets group. The "black siliceous rock" and the amygdaloidal rock" I take to be the rock on the shore, and the 20 foot high cliff of the same rock near the top of the bluff close by; but although the stratifica-

tion is much obscured by cleavages the rock seems hardly to form a dyke. As observed last year in September, the dip in the cliff appeared to be 80 degrees N. 30 degrees E.; in the rock on the shore, 80 degrees S. 45 degrees W.; and the course from one exposure to the other to be N. 50 degrees W. A hasty independent observation this year gave the strike of the rocks on the shore as roughly S. 40 degrees E. According to last year's observations the rock on the shore is a very hard, but rather friable pebble rock of jaspery looking, but really feldspathic very dark brown almost black pebbles of irregular more or less rounded shapes, egg size and less, cemented together by the same material and containing numerous white masses of chalcedony from the size of a mustard seed up to that of a turkey's egg. These masses are in the pebbles, but sometimes perhaps form pebbles themselves. The rock of the cliff is in parts less pebbly and is of green, veined, gray weathering, jaspery looking material; but is in other respects just like the rock on the shore and contains just such masses of chalcedony. In the rock on the shore those masses look strikingly like imperfet fossils, most of them very imperfect, so rounded as to lose almost all character; but in some cases seem almost recognisable. One, for example, appears to be a terebratula of the size of a filbert; one looks like the head of a crinoid with a portion of the foot stalk preserved; others look a little like echinoderms. There are also some thin veins of chalcedony running though the rock.

A ri or so beyond Kuroiwa the bluffs and hills on the right disappeared, at the side of the broad flat valley of the Yurap river. Along here the beach was soft and progress rather slow, and it grew dark. A ri beyond that we left the beach and took the still softer sandy road a few hundred yards from the shore thinking to come soon to the Yurap ferry. The poor horse finding a good

soft place in the road deliberately dropped down with fatigue, and I had to lead him to the ferry and part of the way beyond. His exhaustion arose not so much from the excessive length of his daily journeys, as from the prevalent dense ignorance everywhere as to the proper manner of feeding and caring for a horse that was working so steadily. Special gratuities to the hostlers had produced little or no effect, and that evening it was necessary in addition to see personally that the needful food and water were given him.

It was half-past eight by the time we had crept along in the moonlight so far as Yamukushinai. The road was level and sandy, along the beach or close by and passed near the old ironworks and over the iron sand deposit which are mentioned in my last winter's report. Nearly a mile short of Yamukushinai a small reef of light gray slightly brownish coarse grit, in part even a pea pebble rock, was observed last year to have a dip of 25 degrees N. 50 degrees E.; likewise another half-way between that and Yamukushnai of the same materials, but still coarser, and somewhat crossbedded, with a dip of 25 degrees N. 60 degrees E. Apparently the same rock with a dip of 25° S. 60° E., but very recent looking and containing a trace of oil was observed at a place 400 yards south of the main oil well. The rocks all probably belong to the Toshibets group.

The bluffs back of the village, 150 yards from the sea, rise to a height of perhaps a hundred feet and have a nearly level plain at the top for half a mile back, and then slightly higher ground reaches perhaps a mile further to moderately high mountains. The plain above the bluffs was nearly open, but did not look very fertile, yet might do for a pasture.

The next morning (20th October) without stopping to look again at the oil springs of Yamukushinai already

spoken of in last year's report we set out for Hakodate, 43¾ miles (17½ ri). The same bluffs interrupted here and there by streams continued as far as Otoshibe (2ri); and the road lay along the beach most of the way. The horse was still tired and stiff, so that we went along very slowly. It was necessary therefore after all to give him up and take a post horse at Otoshibe, and the change was made as quickly as possible. The new horse proved a prize in the lottery, and took me rapidly to Mori (4 ri), past Washinoki with its oil and its limestone described in the report of last Christmas. The road was almost always on the beach, alongside of high bluffs with many exposures of the greenish-gray soft sand rocks of the Toshibets group. Here and there a small village was passed through, where the mouth of a valley gave space for one.

At Mori it was necessary to change horses again according to rule; and this time a blank was drawn in the lottery. It was a violent kicker and one that being accustomed only to follow others in a train could only with the greatest difficulty be urged past any horse we overtook on the way. We had however the New Road to travel on, and succeeded in climbing over the dividing ridge about 1000 feet high, and descending to Togeshita at the rate of about two ri an hour. It was impossible of course to enter Hakodate with such a horse, even if he had not been already tired out, and another change was made at Togeshita, and a real prize obtained. For I insisted on riding the horse of the horse boy that was sent with me; and found he had chosen very well for himself. In that way we rode past Nanai farm with its buildings that now look so neat from the road, and then down the long descent into Hakodate, and arrived soon after five o'clock, less than 27 hours from Oshamambe (27 ri).

On the Mori side of the dividing ridge the only rocks noticed were pumice from the Komangadake Volcano near by. Above Togeshita there was an exposure of an older looking volcanic, reddish, probably feldspathic rock with a dip of perhaps 45 degrees westerly.

The road was having many of its small bridges renewed. Near the top of the mountain were still to be seen the only half obliterated traces of the cross ruts made by the horses in the mud of last winter. If not repaired properly the effect must be still worse this winter.

In the fifty-three days from Nemoro to Hakodate my travelling amounted to 819 miles (327.6 ri), an average of 15,45 miles (6.18 ri) daily. Taking out the ten days of the boat and foot journeys (96½ miles, or 38,6 ri), necessarily much slower though requiring more hours each day, the daily average of the rest was 16,80 miles (6,72 ri) ; rather more than what is considered a good average for cavalry men, or for the horses of street railways. The extreme roughness of much of our roads should also be borne in mind, as well as the fact that all the topographical and geological work (including the gathering of very numerous rock specimens) and some mapping were done in the same time, besides about 100 pages of this report written and copied and thirty odd pages more of the rough draft finished. The work to be sure with the exception of the last few days was less severe than that of last autumn, and intentionally so ; not because the efforts of that season seemed to be wholly unappreciated and taken as a matter of course, but because it was physically impossible to repeat them. The comparative exhaustion they produced, together with the lack of any good rest through the winter and the fatigues of the Ishcari trip eventually brought on such extreme emaciation as peremptorily demanded a better care of health, which happily resulted in an average gain of

about half a pound of flesh a day all the way from Nemoro to Hakodate.

Yedo; 14th November.—Messrs. Day, Munroe and Boehmer were at Hakodate on my arrival, and we all occupied the same house. Mr. Munroe reported verbally that he had written me two or three letters not yet received; that he had finished the gold survey at Ichinowatari near Matsmai (not the Ichinowatari near Ono) without any very good prospect of workable gravel; that he had afterwards taken his party to Birô and Berufune, but with careful washing of large quantities of earth there and at various other points along the coast had found scarcely a trace of gold; that he had then according to instructions taken the party to the Mombets coal field, and after setting them fairly at work there had himself started for Yedo in anticipation of the termination of his agreement with the Kaitakushi; that there were only comparatively thin beds of coal so far discovered on the Mombets, but that they were said to be the best of all that region. After his arrival in Yedo from his trip hither overland, I shall be able to give you fuller particulars of his season's work.

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While at Hakodate Mr. Boehmer gave an account of some very interesting Aino customs that he had observed. He and his Japanese travelling companions had gone from Saru (beyond Yubuts) five ri up into the country, as far as the tomb of a Japanese named Yoshitsune, who lived 700 years ago, and was exiled from Nippon. At the grave on a wide stream is a small temple, as large as a table of middling size; and the memory of the dead man seems greatly to be venerated by the Ainos. There were seven Aino villages on the road, each with its chief and the principal chief of them all was in the uppermost village; and the party was received there in his house by

all seven chiefs. He was a man fifty or sixty years old; the others were said to be over eighty and had white hair and beards. They were dressed expressly for the occa- occasion in handsome robes embroidered with blue and wore crowns of straw decorated with red flannel and bits of tin. The house was unusually large perhaps forty feet by thirty; the floor was covered with colored rush mats; dried salmon hung aloft; on one side behind the fire place were raised beds with deer skins, not too cleanly looking; though the house in general was much neater both inside and out than the common Aino houses, and was very neatly thatched. Within were Japanese gifts that had accumulated for perhaps a score of generations, old swords, rice dishes and lacquered ware; the oldest much the best and very handsome, the newest merely plain lacquer. The visitors ate the lunch they had brought and the Ainos drank some of their own sake, which the others found quite too bad to drink. The Ainos in drinking raised their heavy moustache with a small stick, somewhat like a paper cutter, made for the purpose and sometimes neatly carved. Before parting the guests made a present of a rio delicately wrapped up up in paper; but it was quickly opened without ceremony, and half rio more demanded so as to buy a whole keg of saké.

The next morning on the sea shore some of the Ainos made a prayer to the sea god to quiet the swollen waves and to send back two boats that had gone out each with two Ainos a couple of days before. The same day an Aino boat that went in search of them brought back one boat, but the other seemed to be quite lost. The two rescued but half starved men were fed on the sea shore, and towards sunset there was a singular dance on the beach. The Aino men of the village formed one line and the women another, and with poles like lances in their

hands went through with many evolutions. Sometimes they would make as if charging with their lances against the sea. Then there was another prayer by an old man facing the sea. After sun down all hope for the other boat was given up, and according to custom the women in all the neighboring five villages devoted themselves to lamentations which they kept up the greater part of the night. They squatted in pairs on the ground facing and hugging each other, and wailed and shed tears. The men did not join in the crying, and the women did not except while squatting.

Our servants and baggage and the old horse did not reach Hakodate until the 21st of October, a whole day after my arrival. The 22nd, 23rd and the morning of the 24th, some progress was made in copying this report and in writing the rough draft. About noon of the 24th we sailed for Yokohama in the steamer Courier, arrived there on the 27th, and came at once to Yedo, The two parties of Japanese assistants were to reach Hakodate before the first of November, but have not yet arrived here. No information has come to me from the one in the Ishcari valley since I wrote you from Nemoro.

Here then at last I bring this report to a close. You will say perhaps that it is a report not only on the geology of our route but on matters and things in general; and that it ought to bear the Shakespearian motto "Sermons in Stones," or rather "Sermons and Stones."

In case perchance through impatience to read the essential record of geological and topographical facts you should have skipped over the rest, I would beg to ask your attention at least to what has been said about the lessees and merchants who receive loans, that handful of monopolists who seem really to possess the island more thoroughly even than the Kaitakushi itself does. The subject, however, is very likely not new to you since it

would be natural enough for the Kaitakushi, immediately on securing your aid as an Adviser, to inform you fully on all matters of such extreme weight in its concerns. Still, some points may have been overlooked, as men often forget the importance to others of information that has long since become familiar to themselves.

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I have the honor to be,
Sir,
Your most obedient Servant,

BENJ. SMITH LYMAN,
Chief Geologist and Mining Engineer to the Kitakushi.

Yedo ; 23rd November, 1874.

VARIOUS LETTERS

ADDRESSED DURING THE YEAR

1875,

TO THE

KAITAKUSHI DEPARTMENT,

BY

HORACE CAPRON,

COMMISSIONER AND ADVISER

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

CORRESPONDENCE

DURING THE YEAR 1875.

OFFICE OF THE COMMISSIONER AND ADVISER OF THE KAITAKUSHI.

Tokio, Jauuary 24th, 1875.

His Excellency,
KURODA KIYOTAKA,
Kaitaku Chokuwan.

SIR,

In compliance with the desire of Department expressed in your letter of the 7th of August last, for a report on the fisheries of Yesso, I have the honor to submit herewith for your consideration such facts and suggestions as the limited time and facilities at hand will allow.

It is but due to myself to remark that hitherto I have been deterred from offering to report exclusively upon this important subject, in part because of the almost insuperable obstacles to a thorough understanding of the value and extent of the fisheries of Yesso, but more especially by reason of the very apparent fact that the Government had resolved upon a policy with reference to its fisheries which completely severed this interest from the scheme of development inaugurated upon the island of Yesso in

which I was immediately interested. The numerous allusions to this subject in my various reports and the suggestions which I have ventured to offer to the Kaitakushi from time to time, both verbally and in writing, will, however, bear me out in the assertion, that I have always endeavored to impress upon the minds of the Japanese authorities the great value of the fisheries of Yesso and the importance of so protecting and controlling them, that they would prove an important aid in the development of the Island. I can only regret that the attention of the Kaitakushi has not been sooner turned to this important subject.

Before any satisfactory results can be obtained from the consideration of this subject, an important question must be answered. It is this: does the Japanese Government desire to treat the fisheries of Yesso as a means to the more rapid development of the Island, or does it regard them merely as a source of revenue to itself? The solution of this question must determine the manner in which the subject is to be treated, and must, to a certain extent, determine also the suggestions that can probably be made.

The satisfactory settlement and development of Yesso, and an increase of the revenue derived from its fisheries might accompany each other. Certainly it is no less than probable that the success of the former would ensure the possession of the latter. But the present course of the Government seems wholly to separate the two, and it is for this reason that I am inclined to think that the Japanese authorities consider the Yesso fisheries merely as a source of revenue, the immediate returns from which they desire to increase, without reference to the influence of their action upon the general prosperity of the Island. A brief glance at the present condition of the fisheries and the system on which they are now managed, will serve to show why I have arrived at this conclusion.

The fisheries of Yesso are farmed out to Japanese, who, in the great majority of cases are residents of other parts of the Empire, and who, with most of the fishermen they employ, remain in Yesso only during the fishing season. The Government exacts from them a tax of from ten to thirty per cent of the value of the catch. From this source it is estimated that the Government derives an annual revenue of $350,000. Until the last season the tax was paid in kind, but the Government then would receive only money. This course has been the source of much suffering and complaint amongst the lessees of the fishing grounds, and has, for the time being at least, partially paralyzed the industry. This result alone goes to prove that but slight dependence can be placed upon a revenue which is held by so frail a tenure, and which is liable to great fluctuations from the slightest causes.

It is hardly necessary to say that the fisheries of Yesso are managed in accordance with the oldest methods, and but little attention is paid to the proper times and seasons of fishing, with a view to the preservation of this important industry. But the greatest lack of progress and improvement is visible in the manner in which the fish are cured and prepared for market. Here at least it might reasonably be expected that some improvement would have been made, and some attention have been devoted to the needs of the markets which have been opened to the products of Japan. Canned fruits, canned meats and canned fish have of late years been exported from several great markets to the extremes of the world, new methods of curing and preserving these commodities have been discovered, and fish and meats are exported to places where they were before scarcely ever known as food. New facilities for preservation have naturally increased the demand. And so profitable has this traffic

been, although the mode of preparing the fish, &c, is no secret, that fish are now brought great distances to the canning establishments simply to be prepared and then are shipped greater distances for market. With these facts in mind it must remain a subject of wonder, why the Japanese, who control the fisheries of Yesso, have not given some attention to the adoption of methods which would make the results of their labour much more useful and profitable. They have all the facilities at hand for supplying distant markets with fine fish prepared and preserved in the best manner, and no market would be inaccessible to them with the peculiar advantages they possess.

The Chinese and Japanese markets, however, are the only ones to which those who have charge of the Yesso fisheries pay any attention. The finest fish are thus thoroughly spoiled for any other palates than those accustomed to the peculiar flavors which result from the processes of curing &c. in vogue. It does not seem to enter into the calculations of the managers of the fisheries that larger profits and surer returns might be had from other markets than those upon which they have depended so long for their prosperity. Year after year they persevere in methods which time should have rendered obsolete, and year after year foreign merchants in Japan sell even inferior foreign fish at a profit.

These facts speak for themselves. The conclusions to which they lead are obvious. No one who has inspected the fisheries of Yesso in even the most superficial manner, could for a moment suppose that $350,000 is an annual adequate return for the value of the property which the government holds in these fisheries. With a coast line of over 1200 miles, the larger part of which is noted either for its fish or its seaweed, and with numerous rivers well stocked with fish (where I have myself witnessed the

taking of over 1000 of the largest sized salmon at one hauling of the seine, and was informed that is was no unusual thing to haul in more than six times that number) there is no room for a doubt that these fisheries may easily be extended many millions of dollars annually.

FOREIGN POLICY.

Cod, Mackerel and Herring fishing was first regulated by legislation in Western Europe at the close of the 9th century. The fisheries of Newfoundland were visited by the French as early as 1504. In 1577 they had 150 vessels at the Newfoundland fisheries. A few years later the Government of Henry the IV took active and earnest measures to protect and profitably develop these fisheries. About 1650 began the trouble between England and France concerning the Newfoundland fisheries, and after the treaty of Ryswick in 1697 the French claimed exclusive ownership of the American fisheries. Once their vessels of war seized and confiscated all British fishing vessels found anywhere east of the Kennebec river in Maine, except on the western coast of Newfoundland where by a specific stipulation in the Treaty of Ryswick the English were permitted to fish. This pretension was in part the cause of the war between these two countries which ensued in 1702. By the treaty of 1813 the French were prohibited from coming within 30 leagues of the coast of Nova Scotia and into Newfoundland waters. Along the eastern and western coasts, however, from Cap Bonavista to Point Ritchie, they fished, and with such good success, although within comparatively narrow limits, that in 1867, the annual income of the French people from this source alone was $5,000,000. Through the successive wars between England and France the Newfoundland fisheries still retained their value. Although the French were soon confined to even narrower limits than after the peace of 1813, their annual income

from this source increased until in 1856 it amounted to $7,000,000. This was owing no doubt in great part to the system of bounties and the hearty encouragement which the French Government always gave to this important branch of industry. These bounties were often large, and were always apportioned to the zeal and industry displayed by the fishermen. Each fishing smack, no matter how small, which left the shores of France to coast upon the bleak and often perilous coast of Newfoundland, was, so to speak, the protegé of the French Government. The fisherman was provided in many cases with an entire outfit, the cost of which, if it exceeded the bounty allowed, he was permitted to defray from the profits of his voyage. Nor did the French Government confine its bounty to those who went immediately from the mother country. The fishermen of Newfoundland, by far the larger class, shared equally in its generosity with those who left France to be gone a season or so at the farthest.

The English equally with the French saw the importance of cherishing and developing this important industry, and they succeeded to such an extent that in 1812 the income from this source alone was $12,000,000. The total value of British fisheries in Newfoundland and elsewhere is estimated at $22,000,000 yielding a net annual profit of $7,000,000 or at the rate of about 32 per cent.

America, too, has profited by fisheries. The colonies even at the earliest stages of their existence profited immensely by their fisheries. At the close of 1600 Massachusetts exported to Portugal, Spain and the mother country (as England was then called) $1,000,000 worth of fish, a very large amount when one considers the comparatively small capital employed. The fishing towns of Massachusetts are famous in history. At the outbreak of the War of Independence they were by far the richest towns in

the colonies, and contributed largely to the successful termination of that contest. They turned their attention at an early stage of the struggle to privateering, for which their training had peculiarly fitted them, and they did much to cripple British trade and commerce in American waters. At the close of the war it was provided by treaty that American fishermen should resume all the privileges they had previously enjoyed in the British fisheries in North America.

So successful was their competition that Great Britain, to protect her own colonies, prohibited the importation of American fish into the British West Indies, which had been one of the most profitable markets for American fishermen.

The United States Government saw the importance of protecting and fostering its fishing industry. In 1789 Congress imposed a duty of fifty cents per quintal upon all imported foreign fish, and offered a reward of five cents for every quintal exported from the United States. In 1792 this was changed to a specific allowance for boats between 5 and 20 tons, $1.00 per ton annually; those between 20 and 30 tons, 50 cents per ton; those over 30 tons, $2.50 per ton, the annual allowance to any one vessel being limited to $170. In 1797 these rates were increased; vessels of the smallest class were allowed $1.60 per ton; vessels of 20 tons, $2.40 per ton and the maximum was fixed at $272. The Act of Congress now in force respecting bounties was passed in 1819. Vessels claiming bounty shall have been exclusively employed in cod-fishing between the last of February and the last of November; three-fourths of the crew must be citizens of the United States. The bounties allowed are as follows: for vessels between 5 and 30 tons, $3.50 per ton; for vessels of more than 30 tons, $4.00 per ton; no vessel to receive more than $350. The bounties amount

annually to more than three hundred and fifty thousand dollars (Act of June 19th 1813 Statutes at Large, Volume 3, page 2. Act of July 29th 1813 Statute at Large, Vol. 3, page 51. Act of March 1817, Vol. 3 page 351. Act of April 1818, Vol. 3 page 417. Act of March 3rd 1819, Vol. 3 page 520.)

The Act of March 16th 1802 (Statute at Large Vol. 2, page 137) permitted the free importation of salt at any fishery in the District of Edenton. The Act of May 24th 1828 (Stat. Vol. 4, page 312) provided for the licensing of mackerel-fishing in like manner with cod-fishing, and by the Act of April 20th 1836 (Vol. 5 paga 16) these vessels were not liable to forfeiture for catching other fish.

The study and comparison of these various Acts enforces the opinion before stated that the American authorities saw at an early date the importance of well sustained and remunerative fisheries. At the close of the wars of '76 and 1812 the fisheries of America were the subject of earnest discussion between the American and British Commissioners. The former were especially enjoined by the Government, not to release one jot nor tittle of the rights already enjoyed by American fishermen in American waters, and the beneficial results of this determination are evidenced in the large concessions made to Americans and in the growth and prosperity of their fisheries.

As has been shown, England, France and America have at all times exhibited an intelligent appreciation of the importance of increasing by legislation the fisheries of their respective countries. This they have done by bounties and important concessions, and the outcome has shown, that not only the fishermen but also the people at large have profited by this. Nor have the income and the increased wealth of these nations been the only results of their action. The hardy and perilous life of the

fisherman has produced a class of men who have proved to be of great service in the event of war.

The better the sailors of a country, the more inured they are to hardship and peril, the more reliance can be placed upon their services as seamen in war. America owes her success in the war of 1812 in a great measure to the fishermen of Marblehead, Salem, Gloucester and Beverly. England could not glory in her Nelson, had not that great commander been supported by men most of whom had gained their training in the fishing smack and the merchantman; and France has always obtained the bone and sinew of her navy from among her fishermen and merchant marine.

I have referred thus extensively to the course pursued by these several Governments for the protection and encouragement of their fishing interests, more for the purpose of preparing your mind for a proposed radical change in the policy of this department, which I desire to lay before your Excellency for your consideration, for the future management of the fisheries of Yesso.

You will perceive that neither of these nations have resorted to a direct tax upon their fisheries for the purpose of revenue, nor have they in any other way encumbered them with complicated laws or burthensome exactions, but have thrown around them the strong arm of the Government for their protection, and encouraged them by heavy bounties.

The great success of the United States system of colonization may be attributed to the liberal policy extended to all of its great national industries, a system which has added nearly 40,000,000 to its population in less than one century, built over 70,000 miles of railways, and increased her annual revenue to over $380,000,000 without the necessity of resorting to a direct tax upon the real estate of the country.

It is an easy matter to point out defects in a policy so open to criticism as this relating to the Yesso fisheries. It is, however, difficult to suggest the necessary changes for its better government, which shall embrace at the same time, a policy acceptable to the political conditions of this nation, especially when it must necessarily involve a thorough and complete departure from all its ancient laws and usages; but no injury can arise from any suggestions I may offer looking to the future advancement of this people and to a condition more in harmony with that of more civilized nations. To do less I should fall short of what might reasonably be expected from one occupying the position I do under this Government.

The importance of these suggestions, like many others which have been made to your Excellency upon different subjects in my former communications, may not receive your immediate attention, or be fully appreciated at the present moment; nevertheless they will appear upon the records of the department, to be tested under the light of future experience, my responsibility ceasing when I shall have properly placed them before you.

The disastrous effects of the present system, which annually brings upon the coast of Yesso, the migratory horde of fishermen gathered from all parts of the empire, is apparent in the deserted hamlets and general dilapidated appearance of a large portion of the coast. Not one of this vast throng remains beyond the short period of the fishing season, to swell the permanent population of the island; nor do they leave a dollar of all this vast wealth which is stripped from one of its most productive resources. It is disheartening in the extreme to be working against such an adverse current, which is supplemented by many others similar in their tendency.

The heavy tax which is exacted from the annual catch of fish upon this island, although assuming formidable

proportions in the gross, is swallowed up in the budget of current expenses of the department, and cannot, I think, be any counterpoise to the pernicious effects of the system upon the progress of the settlement and development of the island. To reverse this current which is gradually depleting this island of its wealth, and turn it to some account in the way of its development is the object of this communication.

My first proposition for the disposal of this question is, to *abolish* the *present tax*, and open the fisheries of Yesso to its permanent residents and to those who propose to become so, freed from every embarrassment of whatever nature.

As an inducement for the immigration of that hardy class necessary to develop those fisheries to their maximum, I would recommend that each head of a family, or each able bodied single man proposing to settle there, should be entitled to receive from the Government a Homestead proportioned to the effective force of his family—not to exceed in any case ten English acres of arable land, conveniently situated to the place he may select for his fishing station, conditioned as follows.

He shall file at the proper office his declaration of intention to become a permanent resident upon the island, he shall build for himself a suitable house upon this land and make other improvements thereon, and shall reside upon and cultivate it for a space of two years (or other period to be decided upon). At the expiration of this time, if he shall produce to the properly authorized officials of this department, satisfactory evidence that he has faithfully complied in every respect with the above requirements, he shall receive from the Government a title in "fee simple" to his Homestead.

On the part of the department it shall be its duty to enact judicious laws, securing to each permanent settler

his right to hold property and transact business, also to issue proper rules for regulating the time, season and proper methods of these fisheries, and for the increase of the fish by the introduction of the most approved systems for propagation, &c.

Further to advance the interest of these fisheries, the Department should erect or cause to be erected through private enterprise, at different points along the coast, establishments for curing and canning the fish after the most approved European and American methods, and encourage these establishments to become convenient markets on their private account.

To establish these home markets on a firm basis, a liberal policy should influence the organization of shipping lines, with vessels to ply between the coast stations and the more distant markets, and individual enterprise should be allowed to compete in this matter to the exclusion of all complications of the present system of "farming out" and all other speculative influences.

Good roads should be constructed where practicable and desirable to connect these coast towns and the interior settlements of the island.

Under this system the fisheries of Yesso would be relieved from its present cumbersome organization, the expenses for which must absorb the larger portion of the heavy tax collected, and in every way it impedes the trade and general prosperity of this department of industry.

Should the above proposition appear to demand too radical a departure from the traditional usages of the country, it may be modified by continuing the present tax on all contractors and fishermen who are not residents on the island, and reducing it to the lowest possible minimum on all those who are now, or, desire to become, permanent residents, and to these I should extend the full

benefits—in all other respects—of the first proposition; and if the long experience of the most enlightened nations in the world is of any value I would advise the further inducement of a bounty for every fishing smack engaged in this service manned by these hardy immigrants.

There can be no doubt that the fisheries of Yesso, and the furs of the more northern islands under the control of this department contain much undeveloped commercial wealth over and above the importance of the fisheries to the food supply of the nation (and this last is no inconsiderable item in estimating their importance). These fisheries, with the minerals, the valuable timber (with a comparatively salubrious climate) could they be brought under a properly matured system of development, one that is more in harmony with this advanced age, and which would meet more nearly the requirements of the new career of commercial prosperity and greatness now opening to this people, the problem for the development and settlement of Yesso would be solved; but on the other hand, if all past experience is to be ignored, and old ideas and customs are to be persevered in I see no reason why the future of that island is not photographed in the history of the past.

Very respectfully,

Yours,

HORACE CAPRON.

Commissioner and Adviser of the Kaitakushi.

OFFICE OF THE COMMISSIONER AND ADVISER
OF THE KAITAKUSHI,

TOKIO, February 5th, 1875.

His Excellency
KURODA CHIOKUWAN,

DEAR SIR,

I have the honor to reply to your letter of the 3rd instant, in relation to the laws of Europe and other countries for the preservation and increase of the wild animals, and the application of those laws to Hokkaido for the preservation and increase of the deer upon that Island.

All European nations have laws for the preservation of game. The English game laws, which are perhaps the most rigid, originated in their ancient forest laws for the preservation of the King's deer, under which laws the penalty for killing a deer was death. Stringent laws still exist and are intimately interwoven with the common law of the country—which being mostly controlled by the large landed proprietors, whose interest it is to preserve the game upon their estates—are rigidly enforced.

The General Government of the United States have hitherto paid little attention to the subject, and the work of extermination of the buffalo, deer, antelope and other valuable wild game has gone on unrestricted by any congressional legislation. The subject, however, is attracting the attention of the public, and will no doubt lead to the adoption of suitable laws for the protection of the Government lands. As new States and Territories are developed, however, laws are enacted by their local legislatures for the protection of all wild game from indiscriminate slaughter, leaving it free, however, for persons to take game under certain restrictions, these restrictions having reference more particularly to the proper season and the methods of capture. As I have no means of referring to these various laws, I cannot give them in detail,

but understand them sufficiently well to enable me to make a few suggestions applicable to your case.

I presume it is in the power of this department to furnish the number of the deer annually destroyed upon the island of Yesso for their horns and pelts sent yearly from its ports, and also from a single fact which came under my own observation, where at one station alone, over five thousand pelts were the annual receipts. The effect of this wholesale slaughter is apparent in the small number now to be seen upon this island, even their "signs" are wanting as an evidence that they exist to any large extent south of the Ishcari river. I have myself seen at one view on an American prairie more deer than have come under my observation in the three years I have been traveling on that island.

My conclusions are that they are gradually disappearing, and will in a few years be extinct, if the present rate of killing is continued. To prevent this, it is only necessary to bring the matter under control by the enactment and enforcement of certain rules, regulating the time, method of killing, and the number to be taken annually.

First.—The time of killing should be restricted so as to protect the does from being disturbed during the rutting season, the time of gestation, and until the young are sufficiently grown not to require the protection of the dam.

Second.—As to the method of killing. The use of poison —with poisoned arrows or otherwise—should be prohibited, as it is not only a wasteful but a barbarous practice; a vast number who are infected with the poison, straggle off into the bamboo undergrowth and are lost. Other methods of killing are less important if the number to be taken each year is limited.

Third.—The number allowed to be taken. This must be determined by estimating the annual increase, as it

is done in the seal fisheries in America which one may readily believe a much more difficult thing to do. Yet it is done and with great accuracy. It is not probable that any such close observations in regard to the deer of Yesso, however, have been made as to afford any correct data, but by taking the number of pelts received in one year, and obtaining from the most intelligent Aino hunters their estimate of the number now on the island as compared with a period of years back, some idea may be formed of the proper number to which it would be desirable to limit the annual killing. As it is very evident, however, that they are rapidly disappearing under the present rates of killing it is desirable to reduce the number very much, for a series of years, until time is given to mark the effects.

Very respectfully,

Yours,

HORACE CAPRON,

Commissioner and Adviser of the Kaitakushi.

TOKEI, March 17th, 1875.

His Excellency

KURODA KIYOTAKA,

Kaitaku Chokuwan.

DEAR SIR,

My attention has been directed to a letter in the "Tokio Daily News," (a native paper published in this city,) containing certain erroneous statements in regard to the climate and resources of Yesso, which, if allowed to pass unnoticed, it is apprehended may have an injurious effect upon the efforts of the Kaitakushi for the development of that island.

There is nothing in the letter worthy of special consideration, except its allusions to the climate of Yesso, and of Sapporo in particular, and they differ in no way from the opinions which were generally entertained upon my arrival in Japan. It is strange that the people of Japan should continue for so long a time in entire ignorance of a portion of their domain, which is neither so remote as to be difficult of access, nor so valueless as to justify neglect.

The observations that have been made during the past three years under the auspices of the Kaitakushi, and the reports and letters which have been presented in reference thereto, have, it seems to me, settled all questions as to the extreme cold of the climate of Yesso and the barrenness of its soil. Certainly no one who is familiar with those observations, or has had access to the reports and letters on file in the Department, can for a moment entertain any doubt as to the frivolous nature of the criticisms in the newspaper article referred to. Successful experiments in the cultivation of the various grains, fruits and vegetables commonly grown in all mild climates throughout Europe and America should alone be sufficient to settle all doubt. But we have, in addition, the record of meteorological observations for the past nine years, which prove beyond question that the climate of Yesso is milder even than the climates of corresponding latitudes in other parts of the world. These facts are treated of at length in the printed report of the Department.

Reference to the situation of Yesso in relation to other habitable portions of the globe, will also tend to confirm what I have said. It will be seen that the southern limits of the belt of greatest population on the earth's surface do not extend far below the most southern parallel of the island, while that belt stretches north

15 degrees beyond the island's northern extremity. With no other knowledge of Yesso, reasoning by analogy, this fact alone could fairly be taken as proof that the climate of the island does not differ widely from that included between the same parallels in other parts of the world. Nor should the modifying influence of the waters which surround the island be overlooked. Their temperature never varies to any appreciable extent, and they must, necessarily, exert a softening influence upon the climate.

As the article to which reference has been made devotes considerable space to considering the location of Sapporo as the capital of Yesso, it is well to say that the climate of that place will compare favorably with the climates of most other capitals. At Sapporo cold, at its maxiumm, has seldom or never touched zero; and there are, on an average annually only 147 days with rain or snow; 218 are entirely free from both, and 144 have skies as clear and cloudless as ever the skies of Italy were.

The question of climate is a most important one and and has not escaped my notice from the first, as will be seen by reference to my report of January, 1872, (pages 48—50,) wherein you will find the following:

"With such conditions and resources the settlement "of Yesso were an easy matter, had we to deal with "the hardy people who settled America. * * * "Exclusive settlement by native citizens gives another "aspect; a people reared in the mild climate of Nippon "cannot be expected readily to adapt themselves to the "more rigorous climate of Yesso, &c., &c."

Again on page 50: "The changes necessary in the "habits and food of the emigrant from the milder climate "of Nippon to that of Yesso must necessarily be slow, "In no case, it seems to me, could it be better facilitated "than by the introduction of a certain amount of foreign "population accustomed to the more rigorous climate of

"Europe and America, to teach the native immigrant by "their example the methods for best meeting and over- "coming the difficulties of his new situation."

Every day's experience teaches the importance of this last suggestion, and I have now only to repeat the advice then given. I feel assured that by putting this advice to a practical test, the Kaitakushi can best meet and most thoroughly silence such criticisms as have appeared in the "Tokio Daily News."

I remain,

Very truly yours.

HORACE CAPRON.

His Excellency

KURODA KIYOTAKA,

Kaitaku Chokuwan.

TOKEI, March 20th, 1875.

SIR,

Some time since you intimated that you would be pleased to receive from me suggestions as to what I considered the most practicable method of opening the Island of Yesso to foreign capital and enterprise.

As I understand your enquiry, you have especial reference to the development of the mineral resources of the Island, and desire to discover the most speedy means of rendering those resources available and profitable.

You would seem to incline to the belief that this can best be done by the introduction of other elements than those now existing among the Japanese people. In this you are, no doubt, correct, but the question you have presented is one of much doubt and perplexity. If you had simply asked me whether I consider it wise to open the Island of Yesso to foreign capital and enterprise, I should

unhesitatingly answer "yes." But when you go a step farther, and enquire *how* this can be done, I am met at the very outset by difficulties that seem well nigh insurmountable.

The anomalous condition of Japan, a country not yet open even to foreign travel; the peculiar jurisdiction which pertains to foreigners, and the jealousy and suspicion with which the people themselves still regard foreign intervention of any kind, are all facts to be taken into account in the solution of the problem you have suggested.

Permit me briefly to refer to the two methods of attaining the object you desire which most readily suggest themselves.

First:—The Island of Yesso might be opened to foreigners subject to Japanese laws and penalties. In other words, the labor and skill and capital of foreign nations might be introduced into Yesso upon an equal footing with native capital, labor and skill.

At first sight this would seem to be a reasonable and practicable proposition. That it is not such, is due to the peculiar condition of affairs to which I have alluded.

It would involve a revision of the treaties of Japan with Foreign Powers. A large portion of the Empire could not undergo so radical a change while existing treaties remain unchanged. The right of ex-territorial jurisdiction guaranteed by treaty to the Foreign Powers would be abrogated so far as Yesso is concerned. Past experience has plainly demonstrated the fact that this is a right to which even the most liberal Powers still jealously cling.

It has been suggested that the difficulty might be obviated by the naturalization of the foreigners who desire to exercise their skill and labor or to invest their capital in Yesso. Were this possible, I do not think that it would be advisable. It has been well said that capital

is naturally suspicious and examines with closest scrutiny the guarantees and safeguards of law, and it is not possible that, with existing opinions, capitalists could be induced to invest in even the most promising undertakings upon such a condition. Nor does it seem probable that those whose labor and skill would be really of service and value in the opening of Yesso, could be procured by such means. Indeed, it is a question whether under the laws of expatriation of most of the Powers represented in Japan, the citizens of such Powers could so far renounce the obligations imposed upon them by the laws and treaties of their own countries as to be able to avail themselves of any inducements offered by the Government of Japan.

Second:—The Island of Yesso might be opened to foreign capital and enterprise subject to laws and regulations imposed by the Government of Japan, and enforced by the tribunals of the countries to which such foreigners as settle in Yesso belong; and under a system of passports granted by the local or national Japanese authorities.

I am aware that this proposition is not wholly in accord with the views generally ascribed to the Japanese Government, but it seems to me the only practicable course, if it is desired to utilize immediately the resources of Yesso by means of foreign capital, skill and labor. Certainly it is the only course to which foreign Powers could at present be induced to consent. When applied exclusively to the Island of Yesso, many of the features which would render it distasteful and repugnant are greatly modified or entirely absent. In a country so sparsely populated as Yesso, where traditions and beliefs antagonistic to foreigners can hardly have gained a strong foothold, the adoption of this proposition does not involve any of the disagreeable consequences feared from its adoption for the

whole of Japan. It has this great advantage, if it is desired to settle Yesso by voluntary and not by forced immigration; that if the foreign capitalist finds there a profitable field for the investment of his capital, and if the foreign mechanic and farmer discover that they can there obtain a fitting recompense for their labours, the native capitalist and farmer and mechanic will not be slow to reach the same conclusions. Once make the return of foreign capital in Yesso perfectly secure, and you have taken, I predict with perfect confidence, the initial step towards securing the immigration so greatly needed. It is hardly a matter of doubt that the infusion of foreign energy and skill will quicken into life and activity the forces upon which depend the prosperity of Yesso; and the stimulation and increase of native immigration will, I feel assured, be one of its speediest and most favorable results.

The adoption of this proposition assumes a more important aspect when we reflect that it may become the means of ensuring greater commercial and political prosperity to the country at large. The commingling of foreign and native immigrants under circumstances equally novel to both, and in a place which neither have been educated to regard as peculiarly and sacredly their own, will do much to harmonize the two elements and to remove those local prejudices which are now regarded as a bar to closer association. Let Japanese and foreigners meet upon an equal footing, labor for the same objects and cherish the same ambitions, and cordial intercourse must be the result. This will naturally extend to other portions of the Empire, and will be the precursor, no doubt, of mutual concession and good will.

Examine the proposition I have made, and you will perceive that it does not necessarily entail any of the evil consequences that at first might be predicted. It

proposes the adoption of just laws and regulations for the government of foreigners in Yesso. These laws and regulations shall be enacted by the Japanese Government, but, so far as foreigners are concerned, shall be enforced by foreign tribunals at the treaty ports. This means simply that foreigners will be governed by the laws of Japan, but that the penalties for the violation of those laws shall be the penalties prescribed by the laws of their own countries, and shall be administered by the tribunals in Japan to which they are amenable.

The last clause of the proposition (*i.e.* as to passports) is to the effect that only such foreigners shall be allowed to take advantage of the concession offered as shall be deemed by their own and the Japanese authorities fit persons to be admitted to such privileges.

By adopting this proposition, so far, at least, as Yesso is concerned, it seems to me that the problem as to the development of that Island will be solved. Its great mineral resources can then be availed of by contract with foreign capitalists, under a system of royalties paid to the government, the latter retaining the ownership and final control of all mines, &c.

Ex-territoriality is, undoubtedly, a barrier in the way of any method of introducing foreign capital and enterprise into Japan. As, however, it is something that cannot as yet be removed, the wisest course is to adopt the best means possible of lessening the difficulties which it entails. I have pointed out what seems to me to be the most feasible way of doing this. I trust it may meet your approval.

I remain,

Very truly yours.

HORACE CAPRON.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT

OF A

ROUGH SURVEY

(IN 1873)

OF THE

YAMUKUSHINAI OIL LANDS, IN YESSO,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI.

Accompanied by a Geological and Topographical Map.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT OF A ROUGH SURVEY (IN 1873) OF THE YAMUKUSHINAI OIL LANDS, IN YESSO, BY BENJ. SMITH LYMAN, CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI; ACCOMPANIED BY A GEOLOGICAL AND TOPOGRAPHICAL MAP.

1.—SITUATION.
2.—LAY OF THE LAND.
3.—GEOLOGY.
4.—OIL.
5.—WORKING THE OIL.
6.—SHIPMENT.
7.—MAP.

Gen. HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

SIR,—I have the honor to make you the following report on the Yamukushinai Oil Lands.

1. *Situation.*—The Yamukushinai oil lands lie in and near the village of that name on the East (or Pacific) Coast of Yesso and on the western shore of Volcano (or Edomo, sometimes called Endermo) Bay, about 15 miles (6 ri) from Mori and 42 miles (17 ri) from Hakodate.

2. *Lay of the Land.*—The Oil Wells are in a low flat plain about 200 yards (100 ken) wide which reaches from the sea beach to bluffs, 100 feet high above tide, that run nearly parallel to the shore, here north-westerly and

south-easterly. Above the bluffs the land is nearly level, but rises gently to a height of 150 feet or more at half a mile from the shore. This high land is cut into valleys by small streams, particularly by the Yamukushinai Brook on the south-east and by the somewhat larger Okotsunai Brook three-quarters of a mile to the northwest. The village and road run along near the beach, and the oil exposures are chiefly just back of the houses, but in one case close to the roadside. They are all within a space of 100 yards (50 ken) in diameter, nearly half-way from the Yamukushinai Brook to the Okotsunai, except a very small one 400 yards further south in the bank of Yamukushinai Brook.

3. *Geology.*—The exposures of rock in place are extremely few in the neighborhood of Yamukushsnai; in fact only three were found. Besides one with a dip of 25° S. 60° E. at six yards up stream from Mr. Kuwada's oil spring, there were two low small reefs in the edge of the sea at about three-quarters of a mile (11 chô) and at about a mile (15 chô) northwest of the Main Well. The dip at the near place was about 25° N. 60° E; at the far one about 25° N. 50° E. On drawing the curve formed by the strike of the beds as indicated by these dips it is seen that the oil of Mr. Kuwada's spring comes in all probability from the same oil-bearing bed as the oil of the other wells.

The curve of the beds of rock from south-westerly to southerly near Mr. Kuwada's well and afterwards south-easterly with dips at right angles to the curve and towards its easterly side shows that the beds lie in the form of a saddle or anticlinal with its axis running north-westerly and south-easterly. The axis sinks pretty rapidly to the south-eastward. The oil exposures are at some distance to the north-east of the axes, especially the best ones near the main well; and there is nothing here to confirm the

idea, that some have entertained, that oil is to be found especially abundant near anticlinal axes. The idea arose probably from the fact that in certain regions oil wells of some depth are most numerous near such axes, because in such places the oil-bearing beds rise to the surface of the ground.

Although all the oil exposures are found merely in the alluvial sand or gravel, yet the oil undoubtedly has entered the alluvium from the underlying bed of more solid, older rock. The rock is no doubt that of the Toshibets Group, which is also abundantly exposed between Yamukushinai and Washinoki and around the Washinoki oil springs; also at and around the Idzumisawa (or Kamaya) oil-springs and at the diminutive oil exposure on the sea shore about a mile south of Atsuta and some four miles north of Ishcaributo. In short, all the oil of Yesso seems to come from rocks of the Toshibets Group.

The rock exposed near Mr. Kuwada's oil spring is a very soft, bluish gray sand rock that weathers brown. It seems likely to be near the top of the oil-bearing bed, while the main well seems to be nearly over the bottom of the same bed. The thickness of the bed appears to be about ninety feet.

The rock of the two dips already spoken of to the northwest in the edge of the sea is a coarse, slightly brownish, light-gray grit, in parts even having pebbles of the size of peas, and at the nearer place still coarser and much cross bedded. The rock of the near reef seems to be just about 1,000 feet below the oil-bearing bed; and the rock of the far reef about 500 feet still lower. It is probable that all the intermediate rocks and those over the oil-bearing bed are also coarse light-gray sand rock, perhaps rather softer than those that have so remained in reefs. Indeed the Toshibets group, as exposed throughout this region, is

generally made up of soft bluish or greenish-gray sand rocks.

The narrow plain between the bluffs and the beach probably consists wholly of alluvium down to the sea level or thereabouts; for the sea once no doubt washed the foot of the bluffs; but reefs of rock may have been left here and there to be covered by the sand and gravel.

4. *Oil.*—The Main Well is about 100 feet back of one of the houses of the village and about 50 yards nearly in front of a Buddhist temple, and was dug in 1872 by the directions of Mr. Enomoto. It is about ten feet square and eight feet deep, and is loosely walled at the sides with wood. The digging was wholly in the sandy, wet, alluvial gravel, and the hole is full of water nearly to the top. Upon the surface of the water we found the oil that had been accumulating during the past year. It was skimmed off and amounted to about 24 gallons (6 to). Twenty-four hours later the oil of one day's yield was skimmed off and found to be a little over three pints (about one sho). The oil (so called) was quite black and very thick and heavy, so as really to deserve the name of tar. Its specific gravity was tested by Beaumé's hydrometer, and was found be that of 11 degrees only. Owing to the thickness of the oil it seemed to be especially good for lubricating machinery, and what we had gathered was sent to Sapporo to be tried in the mills there. Mr. Holt has since told me that it in fact turned out very good for that use.

Within some three or four yards of the well there is a thin layer of hard, dried tar or asphalt amounting to perhaps 25 cubic feet.

Abundant bubbles of gas rise from the bottom of the well.

The Merchant's Well was dug by a private merchant at the same time as the main well, is about 70 yards south

easterly from it and 50 yards from the Temple, and is a hole perhaps five feet across and eight feet deep. It seems to be dug wholly in the same alluvial sandy gravel and is loosely walled at the sides with twigs and is full of water. We skimmed off the oil that has accumulated upon the water during the past year ; but it was too much mixed with sticks and leaves to be good for any thing. Twenty-four hours later we found that scarcely a spoonful of oil had risen to the surface in one day. The oil is in fact thick black tar, just like that of the Main Well.

A small oil well about two feet long by half-a-foot wide and a foot and a-half deep was dug in the same alluvial gravel (in 1872 by Mr. Enomoto, it is said) about 200 feet east of the Main Well, and ten feet back from the southern edge of the road. It is nearly full of water and has a thick scum of black, tarry oil upon it. Near it there is on the ground perhaps a dozen cubic feet of asphalt.

Another small oil-well, apparently an old digging, is six yards southerly from the last mentioned one, and is a dozen feet long by half-a-dozen wide and some three feet deep. It has a thin film of black tar on it.

About ten feet northerly from the Main Well there is a trench some three yards long by a foot and a-half in width and depth. It is two-thirds full of water with a thin scum of tar. Near it is a little more asphalt, say two cubic feet.

On either side of the approach to the Temple, passing between the Main Well on the one hand, and the Merchant's Well and the road-side oil exposures on the other, there is a ditch. In the easterly one there is a good deal of oil on the water, but in the westerly one (towards the Main Well) very little.

Two telegraph post holes, it is said, were dug in 1873 by the road side ; one at a dozen yards northwesterly of

the little well of Mr. Enomoto's by the road, and the other 200 feet farther in the same direction and close by the north-west corner of the house that stands in front of the of the Main Well; and in both much issued, but they were filled up before the time of the survey.

A water well was once dug, they told us, five or six feet deep about ten feet back of the house just mentioned, but was filled up again, because so much oil came into it.

Mr. Kuwada (assistant geologist) also succeeded in finding a small oil-spring in the gravelly bank of Yamukushinai brook at about 400 yards south of the Main Well; but the yield is scarcely more than a mere trace. Within six or eight yards up stream and down stream from the oil there are four or five insignificant cold sulphur springs, yielding a deposit of white slime, apparently sulphur) and enough sulphuretted hydrogen to give out a strong smell. The oil here comes from alluvial gravel.

Oil was found at no other place, but some bubbles of oil-gas came from a spring of water in the garden of the principal hotel.

The whole daily yield of oil, then, at all the exposures is probably less than half a gallon (say one sho and a quarter); almost all of it at the main well and scarcely more than traces elsewhere. The asphalt at the different places amounts in all to perhaps forty cubic feet, or say a ton and a half; of which about two-thirds is near the main well, and nearly one third by the small roadside well.

5. *Working the Oil.*—The oil would seem to be chiefly confined in the bed which bears it to a very small space around the Main Well, and to exist only in traces at a greater distance, as at Mr. Kuwada's small oil spring. Although half a mile of the outcrop was included within the limits of the survey no other oil exposures were found; and none are known at a greater distance. If the

bed were rich in oil outside of the immediate neighborhood of the Main Well, it is probable that some signs of it would have been observed here and there in a country that has been so thoroughly explored by its inhabitants.

In making a special search for such exposures, however, it is not now necessary to look in every direction at random ; for the map of our survey shows the probable place of the oil-bearing bed at its out-crop and at lower levels. The course of the out-crop for the first half mile from the seashore is in general southerly as far as to Mr. Kuwada's oil spring, and thence south-westerly. At the Temple it rises south-westerly to the top of the bluff, from which it descends easterly to Mr. Kuwada's spring. The out-crop is over 200 feet wide for the first quarter of a mile from the sea shore, and in the next quarter of a mile, owing to the shape of the ground combined with the dip, widens temporarily to some 400 feet. In the corresponding space the course of a line drawn at a given level (say that of the sea) on the surface of the bed (or say half-way between the top and bottom of it) forms a curve almost like the arc of a circle, hollow towards the west. The dip of the rocks is everywhere at right angles with that curve and towards the easterly side.

The oil-bearing bed therefore dips into the ground only on the easterly side of the outcrop, and it would be useless to search for it to the west. Digging or boring to the westward could at best only reveal some other oil-bearing bed ; but there is no evidence nor probability that any such bed exists there and sinking of wells in that quarter would be only a waste of money. The search, then, would be confined for shallow digging to the immediate neighbourhood of the outcrop as marked on the map, and for deeper wells to the country lying easterly of the line of out-crop.

Shallow wells dug in the alluvial plain, near the Main Well, would encounter much water in the sandy gravel, so as to make the work very difficult. Although the oil seems to be more abundant in that space than anywhere else the cost of digging compared with the small yield of even the Main Well is a complete discouragement to the sinking of any more wells there. If any should however be attempted it may be borne in mind that the edge of the oil-bearing bed below the alluvium would be a few yards easterly of the place where the bed would crop out if continued upwards to the surface of the ground. On the other hand the oil on entering the sandy alluvium would probably spread to some little distance in every direction, like water dropped upon a sponge. Owing apparently to the two causes just mentioned the Merchant's Well and the roadside small wells show signs of oil, although outside of the outcrop as marked on the map.

Following the outcrop, however, southerly to the foot of the bluff, trial pits might easily be dug in the hillside in such a way that they would drain themselves. As such a testing of the oil bed at its outcrop would cost very little it may be thought worth while, although there is not much prospect of finding a good yield of oil. The place to dig near the foot of the hill is all the way from the western corner of the temple to a distance of a hundred yards south-easterly. There seems to have been no well dug at the Temple, but within the space just described at least two post holes for the telegraph line, as finally fixed just in front of the temple, were dug below the foot of the bluff without apparently finding any trace of oil. Nevertheless there may very likely be just below the hill a pretty thick mass of loam that has slipped and been washed down the hillside in the course of time; and as such loam would be less pervious

to the oil than the light sandy gravel of the plain below, the post holes may for that reason have failed to find any traces. Higher up the hill side (south-westerly) the loam would be less thick, and a shallow horizontal digging would probably reach even to the solid rock and show whether the bed contained oil there. Similar trial pits might easily be dug along the outcrop in the steep hill-sides to the east of Mr. Kuwada's oil spring and on the easterly side of Yuoi Brook for a quarter of a mile at least up stream from that spring. The probability however, is that the traces of oil would be smaller and smaller the greater the distance from the Main Well, until they disappeared altogether.

But if the result of such an easy test of the outcrop along the hill sides should contrary to reasonable expectation prove encouraging, then borings of some depth might be made upon the oil-bearing bed of rock to the dip, that is, on the easterly side of the outcrop. The dip near the main well would bring the bed to a depth of 100 feet easterly below the sea level at a distance of about 175 feet easterly from its position at sea level; to a depth of 200 feet at twice that distance or 350 feet; and so on. Half a mile southerly from the main well along the course of the bed the dip is gentler, and would cause a difference of 100 feet in level only at a distance of about 250 feet south-easterly. Besides the depth below the sea level at which the bed may be counted upon at any point, the height of the ground there above the sea must be borne in mind in order to estimate the full depth of the well.

It would be best at first not to bore so far away from the outcrop as to need a very deep well; the cost would be too great to be justified by the very uncertain prospect of success. The first wells bored, therefore, should not be more than a hundred feet or at most 150 feet or so in depth. They could be bored by hand with

light boring apparatus that would make a hole of two inches and a half or three inches (0,25 shaku) in diameter. If such wells proved a grand success (contrary to what might be expected), then by degrees deeper and deeper ones might be bored at greater and greater distances easterly from the outcrop. In that case, for very deep boring, where boring by hand would be very costly' some heavier more complicated machinery might become advantageous. But such a result is extremely improbable; and moreover the transportation of heavy machinery would require the building of roads such as do not now exist anywhere in the region, and keeping the machinery in repair would be very difficult at such a great distance from anything like machine shops (at Sapporo, Hakodate or Yokohama).

In sum, then, it is highly improbable that well boring could ever be done here to advantage, still less very deep boring; but some shallow trial pits could easily be dug along the outcrop in the hillsides in order to test the oil-bearing bed of rock. Here is no likelihood whatever that the bed would prove richer in oil at a great depth than it is along the outcrop. The richest part of the bed is probably close about the Main Well and the small road-side wells.

6. *Shipment.*—The facilities for shipping the oil (in case it should ever be found in large quantities) are not very good. There is however a pretty good, nearly level road for pack-horses along the shore of Volcano Bay to Mori; and thence the new wide road to Hakodate, the nearest harbor. At Yamukushinai there is not a trace of a harbor; but in fair weather a vessel might lie off the shore and be loaded with oil barrels from small boats. The water is shallow and the exposure towards the east winds and the open Pacific is complete.

7, *Map.*—The surveying for the map was done by Messrs.

T. Yamauchi, T. Kuwada, J. Takahashi and T. Saito, Assistant Geologists, before my visit to the place, and consequently with only very general instructions. The work was done with imperfect prismatic compasses and pacing; but the unavoidable errors were probably of little consequence for the object aimed at. For the different topographical points laid down on the map can at the most (even by accumulation of errors) differ but a few yards from the truth, whereas the inevitable geological uncertainties would commonly lead still more largely to inexactness in the results; as, for example, in estimating the depth of the oil-bearing bed of rock at any given point.

The map shows the shape of the ground by contour lines drawn ten feet apart in level; showing, for instance, what would be the shore line if the sea should rise ten, twenty, thirty or any other number of tens of feet; such lines of course come very near together on a steep hillside, but are far apart on nearly level ground. By means of the contour lines the height of the ground at any point, even between them, can be closely estimated A knowledge of the height of the ground is necessary not only in determining the relative geological position of the rocks exposed, and the place of the outcrop of the oil-bearing bed, but in estimating the depth of the bed at any given point before boring there.

The depth of the oil-bearing bed below the sea level is shown on the map in the same way as the shape of the ground is shown, by curves (or contour lines of the bed) drawn at 100 feet apart in level. As the shape of the bed, a large saddle, or the top of a wave, is far more simple than that of the surface of the ground, its curves are much more regular and nearly parallel and equally distant, and could hardly be mistaken for the surface contour lines. But in addition they are drawn with

broken lines to prevent the least possibility of confusion. They show at a glance what portion of the country represented by the map is underlain by the oil-bearing bed; and their absence in the rest of the map shows where it would be wholly useless to dig or bore.

The probable place of the outcrop of the oil-bearing bed of rock is marked on the map by straight, nearly parallel lines, drawn across the outcrop about at right angles with it. The outcropping edge of the bed of rock is, however, covered almost everywhere by a greater or less thickness of sand, gravel or loam, especially in the narrow plain between the bluffs and the sea; where such loose alluvial matter amounts to several feet (perhaps a dozen or more) in thickness. As the outcrop is marked as if the bed reached to the surface, its upper edge really to be found under the alluvium would be a few feet more easterly.

As there are no roads except the main one near the sea shore, the lines of the survey were mostly straight ones cut through the woods at right angles with one another; but the sea shore and Yuoi Brook were run in addition. On each straight line stakes were set up at every 200 feet, and their level taken; and they would be of great use in finding upon the ground any point that may have been selected on the map. For that purpose also each stake has a mark of its own; namely, a small letter of the alphabet besides the page (or folio) and volume of the surveyor's note-book and his initial (Q for Kuwada.) As there are in the note-books but 99 folios, the volume is indicated simply by a digit preceding the two used for the folio; as "213", for the thirteenth folio of the second volume. On the map the surveyor's initial and the page number are written only once for each line, and the small letter for each stake; but the last digit of the number is given where a new page was begun.

Besides the stations marked with stakes many others were fixed in position and level, where there was some change in the shape of the surface, such as a summit or a stream. The position of many houses, too, was fixed and mapped, when they were near the lines; but some at a greater distance have been omitted. Such fixed points as these are of course even better than the less-permanent stakes for finding on the ground any desired place that is marked on the map.

On the same sheet with the map is a cross-section passing through the Main Well at about right angles with the strike, and showing the position of the rock beds with their easterly dip, especially the place of the oil-bearing bed.

Each of the surveyors plotted his own line and drew the neighboring contours; but Mr. Kuwada has had special charge of uniting the whole finally into one map with the adjustment or correction of the various errors. Mr. K. Makino has traced the map in strong black lines upon white cloth in such a manner as to be well suited for copying by photography. The lettering has been done by Mr. S. Misawa. The final mapping has all been done under my own eye and guidance.

It has seemed especially necessary to explain the different features of the map so minutely to the Kaitakushi because, while we have a number of others like it nearly done, it happens to be the first one of the kind yet finished in Japan.

I have the honor to be,
Sir,
Your most obedient servant,
BENJ. SMITH LYMAN.
Chief Geologist and Mining Engineer to the Kaitakushi.

Yedo; 17th April, 1875.

ERRATA: On pages 594 and 598 instead of "Yamukushinai Brook" read Yuoi Brook, and instead of "Okotsunai Brook" read "Yamukushinai Brook.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT

OF A

ROUGH SURVEY

(IN 1873)

OF THE

IDZUMISAWA OIL LANDS, IN YESSO,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI.

Accompanied by a Geological and Topographical Map.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT OF A ROUGH SURVEY (IN 1873) OF THE IDZUMISAWA OIL LANDS, IN YESSO, BY BENJAMIN SMITH LYMAN, CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI; ACCOMPANIED BY A GEOLOGICAL AND TOPOGRAPHICAL MAP.

1.—SITUATION.
2.—LAY OF THE LAND.
3.—GEOLOGY.
4.—OIL.
5.—WORKING THE OIL.
6.—SHIPMENT.
7.—MAP.

GENERAL HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

SIR,

I have the honor to make you the following report on the Idzumisawa Oil Lands.

Situation.—The Idzumisawa Oil Lands lie close by the sea shore about a mile (half a ri) easterly from the village of that name in Oshima province, Yesso, and still nearer to the small village of Kamaya on the other side; and about 12½ miles (5 ri) westerly from Hakōdate.

2. *Lay of the Land.*—The sea shore just against the oil lands runs north-easterly and south-westerly and is met nearly at right angles by two or three very small

brooks. The land between the streams rises from the sea in three broad terraces with rounded edges some 120 feet, 180 feet and 228 feet high within a distance of about half-a-mile ($\frac{1}{4}$ ri); and less than a mile further back becomes a hill some six hundred feet high. The little valleys are very steep-sided with here and there small cliffs. The land is almost wholly open, covered with grass or at most low brush in spots, and scarcely a trace of forest trees. There are no dwellings within the limits of the survey.

The oil exposures are wholly within ten yards of the Main Well, about half-a-mile from the sea shore; and are only in holes dug there in the bottom or sides of a little valley only a few yards wide.

3. *Geology.*—In the beds of the streams there are pretty numerous rock exposures; and the dip shows very clearly the structure of the rock beds to be that of a great saddle or anticlinal with the axis about 1000 feet east of the Main Well and running north about 15° (magnetic) west and sinking steeply towards the corresponding southerly direction, and still more steeply so near the sea shore. The dips on the westerly side of the axis are generally about twenty degrees; but also grow steeper up to 30 degrees or perhaps even 45 at a distance of half a mile or so from the axis. On the easterly side the dips are some 65° at 250 yards from the axis and three-quarters of a mile from the sea, but only 45° at 100 yards from the axis. The dips on the axis seem to be about 20 degrees at half-a-mile from the sea but growing steeper to 25 degrees, 30 degrees or even more at 250 yards (125 ken) from the sea. There are perhaps some smaller undulations on the sides of the main saddle, which would account for a few irregularities of dip as observed; but these can also be well accounted for by the uncertainties of the observation in those cases; for the true direction

or amount of the dip was sometimes very hard to make out.

The rocks doubtless all belong to the Toshibets Group, and are chiefly soft greenish-gray sand rock. Although the beds of this group here and elsewhere are folded with such steep dips, some of them at other places contain fossils which have a very recent look; and they probably belong to a late Tertiary period perhaps newer even than the Miocene. Here, however, the only fossils found seemed to be small serpulae the same as are found near the Yurap Lead Mines. At Tomigawa only ten miles (4 ri) from the oil towards Hakodate the same group of rocks contains a thin (one foot) bed of lignite, far more recent-looking than the coal of the Horumui Group, which can itself be hardly older than the Tertiary.

The oil-bearing bed seems to be not more than ten feet in thickness. All the other beds of rock, exposed here and there through a thickness in all of about 1,700 feet reaching to about 1,000 feet below the oil-bearing bed, are chiefly soft bluish-gray sand rock weathering first greenish gray and then brown; sometimes the rock is a pepper-and-salt gray sand rock; sometimes it is a bluish-gray sandy shale. The fossil serpulae are very abundant and are found at almost every exposure.

4. *Oil.*—The Main Well goes through the alluvium into the rock below, and is nothing but a hole about four yards long by a yard and a half wide and two yards and a half deep, about half full of water and with no curbing. The oil comes almost wholly from the west corner where bluish-gray rather coarse, somewhat shaly, broken sand rock containing bright-green specks and apparently traces of fossil serpulae is exposed above the water to a height of two feet. The rock at that point has been undermined so that there is at low water a cave perhaps three feet and a-half deep towards the south-

west. The alluvium there above the rock seems to be quite free from oil; which however drips from the part of the rock exposed above the water. About 82 gallons (2 koku 1 to) were taken at the well as the accumulation of a whole year past; and for three days afterwards an average of two quarts and $2\frac{3}{4}$ gills ($1\frac{1}{2}$ sho) were obtained. The oil was like that of Yamukushinai black and very thick and so heavy as to mark eleven degrees of Beaumé's hydrometric scale. No doubt such thick oil would be especially valuable for lubricating machinery.

Another large hole some five yards down stream (S.E.) from the Main Well has but little oil on the surface of the water. The oil there comes clearly from the bluish-gray sand rock, which becomes greenish-gray in weathering brown. The alluvium in the upper part of the hole yields no oil.

Much nearer to the Main Well and between it and the brook are two holes about 3 yards long by a yard wide dug wholly in the alluvium. The down stream one has a thick continuous scum of oil upon the water; the other has only a trace of oil.

About eight yards above (west of) the Main Well a hole of about three yards in diameter has been dug in the hill side exposing bluish-gray sand rock with a dip of 20° S. 40° W.; but no oil was found there.

The oil at all the exposures is of the same color and character as that of the Main Well; and the yield of that well may be taken as the whole yield of them all. No asphalt nor gas was observed near them.

5. *Working the Oil.*—So very small a yield considering the number of holes that have been dug, gives little encouragement to further trials by digging and still less by boring; especially as the outcrop of the oil-bearing bed is very extensive in the space surveyed, to say nothing of the surrounding country, and has so far nowhere

been found to contain any oil. If rich in oil anywhere but at the Main Well, it would no doubt have given rise to oil springs as it did there. Even if the rock itself were covered with a little alluvium, the oil would have entered such porous gravel or loam and have made itself seen and smelt in a region that has been so thoroughly examined not only by our surveying party but still more widely by the inhabitants.

If, however, it should be desired to test the bed by digging, its outcrop could easily be opened along the south-westerly bank of the small brook for about 700 yards up stream (north-westerly) from the Main Well. There the outcrop seems to cross the stream and to run northerly about 400 yards up to the hill top. In the other direction from the Main Well the out-crop runs about 400 yards south-easterly, and then about N.N.E. for 600 yards at least. The outcropping edge of the bed is probably nowhere covered by any very great thickness of alluvial matter, especially on the steeper hill sides, so that the solid rock could no doubt easily be reached by digging. In most places, too, the pit could be so driven into the side of the hill as to drain itself, and let the water give no trouble. The result of a trial of the outcrop of the oil-bearing bed may be taken as a fair indication of the richness in oil at a greater depth. As the oil beyond doubt originated by the slow decomposition of the remains of water plants or animals in the bed of rock where it is now found; and as those remains were deposited on the bottom of the sea at the same time with the other materials of the rock, before the bed was tilted up or the valley scooped out and the present surface of the ground took shape; there is no reason whatever to suppose that there is at a distance from that surface any greater accumulation of such remains or of their resulting oily products than near the outcrop (making allowance,

however, for the small amount of drainage away of the oil that may have been taken place at points where the out crop is favorably situated).

If the trial of the out crop should however prove unexpectedly encouraging, borings might be made to some depth on the outside of the half circle (roughly speaking) which the outcrop forms. On the westerly side of the axis the depth of the bed increases in the direction of the dip at the rate of 100 feet for every 272 feet of distance or thereabouts, to a depth of perhaps 300 feet below sea level and somewhat more rapidly after that. But on the easterly side of the axis the depth increases much faster; at the place where the dip is 45° the depth of course would become 100 feet more for every 100 feet of distance; and where the dip is 65 degrees the bed would be 100 feet deeper at only some 47 feet of distance. In estimating the depth of any proposed boring and reckoning from the comparatively regular curved line where the bed would be found at sea level it must be borne in mind to add the height of the ground to the calculated depth of the bed below sea level. It would of course be very foolish to begin at once with a very deep boring; for borings made by hand to a depth of a hundred feet or so would amply test the bed. In case of good success with them it would be time enough to make deeper and more costly borings.

6. *Shipment.*—Although there are no roads now close about the oil wells, yet as the land is all nearly open and free from any obstacle, it would be very easy to make even a wagon road for carrying away the oil that might be found. Pack-horses can already go almost everywhere there. The oil could either be carried by land along the present bridle-path or an easily built wagon road to Hakodate, twenty miles (8 ri), or in fair weather could be shipped thither by boats or larger vessels from

either of the slightly shetered roadsteads of Kamaya or Idzumisawa or even from the more exposed shore close by the Wells.

7 *Map.*—The map shows by contour lines ten feet apart in level the height and shape of the ground for half-a-mile or more in all directions from the oil-wells. The probable shape and position of the oil-bearing bed of rock is also shown by similar but much more regularly curved (broken) lines drawn for the sea level and for other levels 100 feet apart down to 500 feet below the sea. The probable outcrop of the bed is also shown by short close lines drawn across it. The map therefore shows at once what parts of the land are underlain by the bed above 500 feet below sea level, and in what direction it would be useless to search for the out crop of the bed by digging or for lower portions of the bed by boring.

In order to lay down on paper the shape of the ground and the position of the rock exposures it was necessary of course to take the levels of many fixed points. That was done by running with the prismatic compass many lines (mostly straight ones at right angles with one another, but sometimes along streams or the sea shore) and levelling (with the hand level) points not more than 200 feet apart (by pacing) and often additional intermediate ones. Stakes were set up at the regular 200 foot stations, and to each one was given a separate mark. Such stations and their marks are reproduced on the map; so that by means of the stakes any desired point of the map may be found on the ground.

The position of the axis is also marked on the map, and a section showing the arch or saddle shaped structure of the rock bed is drawn for a line passing through the main oil well at right angles with the axis.

The surveying was done by Messrs. T. Yamauchi, T. Kuwada, J. Takahashi and T. Saito, Assistant Geologists,

under very general instructions only. Each line was plotted and its topography drawn by its surveyor; but Mr. Saito tookmore particular charge of putting together, adjusting and copying the plottings into one map and after his absence, when the work was in great part done, Mr. Kuwada took his place. The whole has been traced by Mr. M. Kubota on white cloth in black strong lines so as to be fit for photographic. The lettering hasbeen worked out by Messrs. S. Misawa and T. Inagaki, Assistant Geologists. The whole of the final mapping has been done under my own eye; and in particular the geological observations and the mapping of the oil-bearing bed were my own work.

I have the honor to be,

Sir,

Your most obedient Servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer to the Kaitakushi.

Shiba, Yedo;
26 April, 1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT

OF A

ROUGH SURVEY

(IN 1873)

OF THE

WASHINOKI OIL LANDS, IN YESSO,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI.

Accompanied by a Geological and Topographical Map.

TOKEI:
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1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

REPORT OF A ROUGH SURVEY (IN 1873) OF THE WASHINOKI OIL LANDS, IN YESSO, BY BENJAMIN SMITH LYMAN, CHIEF GEOLOGIST AND MINING ENGINEER TO THE KAITAKUSHI, WITH A GEOLOGICAL AND TOPOGRAPHICAL MAP.

1.—SITUATION.
2.—LAY OF THE LAND.
3.—GEOLOGY.
4.—OIL.
5.—WORKING THE OIL.
6.—LIME-STONE.
7.—MINERAL WATER.
8.—SHIPMENT.
9.—MAP.

GENERAL HORACE CAPRON,
Commissioner and Adviser to the Kaitakushi.

SIR,

I have the honour to make you the following report on the Washinoki Oil Lands.

1.—*Situation.*—The Washinoki Oil Lands are on the Washinoki Brook at the western outskirts of the village of that name on the south-westerly shore of Volcano (or Edomo) Bay, about 2½ miles (1 ri) north-westerly from Mori, and 30 miles (12 ri) from Hakodate.

2.—*Lay of Land.*—The shore of the Bay near the oil-lands runs north-westerly, and the Washinoki Brook meets it at about right angles. The land rises steeply on the seashore and on both sides of the Brook, and shows remains of terraces at heights of about 45 feet, 75 feet, 160 feet, 200, feet 230 feet, 255 feet, 280 feet, 300 feet, 375 feet, 420 feet, 500 feet; and rises at a mile and a half from the sea into hills 600 feet high on either side of the Brook, and, a quarter of a mile further back, into one 700 feet high on the north-west. The two lower terraces are especially well marked along the sea shore; some of the others appear only in scattered traces further inland, and may perhaps be doubtful.

The oil exposures are along the brook from a third of a mile (in a straight line) to three-quarters distant from the sea. The village reaches to the mouth of the Brook but lies chiefly to the south east of it. The land covered by the survey, about three-quarters of mile or more in all directions from the Main Well (the uppermost exposure), is almost without an exception wild; and for the most part covered with light woods or at least brush.

3.—*Geology.*—On the Brook there are numerous rock exposures that show the dip, and the structure of the beds to be that of a saddle or anticlinal with a basin or synclinal on either side and with many smaller, subordinate waves on the surface of the main ones. The axis of the saddle seems to cross the Brook at a point about 500 yards from the sea, and to run S. S. W. by S. passing about 1100 feet easterly of the main well. The dips on the westerly side of the axis along the Brook are generally very steep, 65 degrees or 70 degrees; but lower down stream near the axis become 40 degrees or 30 degrees; and, near the sea, on the easterly side of the axis, only 20 degrees or less.

Besides the dips observed on the Brook there are some

on the sea shore at the limestone exposure three-quarters of a mile northwest of Washinoki, showing a sharp basin or synclinal in the rocks. It is perhaps the same basin that crosses the Brook 1000 yards above the Main Well. At the sea shore the dip is 85 degrees on the westerly side of the axis of the basin and only 60 on the easterly side at 20 yards from the axis. On the Brook the dips on either side of the axis and near to it are 60 degrees or 70 degrees; but on the westerly side become gentler to 20 degrees at 250 yards from the axis, though steeper again to 40 degrees or more within 150 yards further off.

The rocks all doubtless belong to the Toshibets group and are chiefly soft greenish (or bluish) gray sand rock. Only two or three imperfect fossils were found here; but those seen at other places are so recent looking as to make the group seem to be of late Tertiary age, in spite of the steepness of its folds here and elsewhere.

There seem to be two oil-bearing beds about 200 feet apart, and each perhaps less than ten feet thick; but there is also a little oil that may possibly come from another bed within fifty feet above the lower one; though probably merely the result of drainage through the alluvium from the outcrop of the lower bed above on the hillside near by. It is possible, too, that the whole thickness from the uppermost to the lowermost of the two or three beds is more or less rich in oil, though there happen to be no exposures to show it. The main well and apparently the chief yield of oil are in the lower bed.

Besides the oil bearing beds about 220 feet apart and the lime-stone beds about 300 feet still lower, there are here and there on the Brook exposures of rock through a thickness in all of perhaps 1,200 feet, reaching to some 300 feet below the lime-rock; and they are almost invariably soft, greenish-gray sand rock. In a few cases, however, as at the upper oil bearing bed there are in the

rock angular fragments or rounded pebbles of volcanic material.

4.—*Oil.*—The oil exposures are at five different places, with more than one small well sometimes at a single place or within a space of a few yards.

The Main Well is at the place farthest up stream. It was dug in 1872 by Mr. Enomoto's directions, and is a hole somewhat triangular in shape, now divided in two. The small hole, is about two feet long by a foot and a half wide and half a foot deep; the larger one is about eight feet long by three wide and half a foot deep. The smaller hole yields a very large share of the oil, which chiefly issues below and at one corner from a crack in greenish-gray soft sand rock at the foot of a small cliff about ten feet high and of a low steep hill-side. The same bed of rock above shows no signs of oil. Some layers below are coarser, harder, grayer and more mixed in material; and at one point bear a white efflorescence. About 15 feet of thickness of rock in all are exposed. The oil is thick, black and tarry and so heavy as to mark (when fresh) 15 degrees of Beaumé's scale at 60 degrees Fahrenheit. A few small gas bubbles rise from the bottom of the small hole. The larger hole is wholly in alluvial gravel between the small hole and the Brook; and the oil seems to pass from the small one into the larger one at a lower level, and is of the same character. The oil that had accumulated during the past year was gathered, and amounted to about three pints (1 sho) for the small hole, and 14 quarts (9 sho) for the larger one or four gallons (1 to) in all. The next two days the small hole yielded a daily average of about seven pints ($2\frac{1}{2}$ sho); and the larger hole about $4\frac{3}{4}$ pints ($1\frac{1}{2}$ sho); or in all nearly 7 quarts ($3\frac{3}{4}$ sho).

The next place, perhaps, in importance is the lowermost but one on the brook and about 400 yards north-

east of the Main Well. It was likewise opened in 1872 by Mr. Enomoto; and is about three feet long by two wide, close to the brook at the foot of a steep bank, and seems to be on a bed of rock 220 feet above that of the Main Well. The oil comes from a greenish gray soft sand rock with feldspathic grains as well as quartz. Small bubbles of gas rise here. The oil is of much the same appearance and character as that of the Main Well, but even heavier; for it marked (when fresh) only 12½ degrees of Beaumé's scale at 60 degrees of Fahrenheit. About 11 quarts (7 sho) of oil were gathered as the accumulation of the past year; and the two next days about 1½ pints (½ sho) were obtained each day. About ten feet up stream and ten feet from the river and ten feet above it there is more of blackish rock and a very little oil issues from a layer half a foot thick of gray sand rock.

The next uppermost place to the Main Well is about 200 yards down stream; and seems to be upon or very close to the out crop of the rock bed of that well, though possibly on the outcrop of another bed within fifty feet above. There are within a score of yards or so four small holes there wholly in the alluvium; and one of them is said to have been first dug forty years ago. It is in gray sand about five yards from the foot of the bluff, is about 3½ feet in diameter and 1½ feet deep, and is half full of water with a thin brownish coating of oil. A few yards to the north-east are two shallow holes about a yard in diameter in the alluvial gravel at the foot of the bluff. The nearer one had very little oil but the other had a good black film of it, a single day's accumulation. This one seems also to be at the edge of greenish-gray, soft, coarse sand rock that is exposed 15 feet above in the bank, with apparently a fossil or two. The fourth oil exposure is a few yards to the north-west on a small

island in the brook, and is in a hole of about a yard in diameter dug in the brook gravel. Within two days after it was dug by Mr. Yamauchi a thick black coating of oil had gathered on the water in the hole; and small bubbles of gas were rising abundantly.

At the lowermost oil place on the brook, apparently on the outcrop of the same bed of rock as the second place a little oil issues from a one foot layer of bluish-gray sandy shales in the midst of a breccia of mostly whitish but partly blackish feldspathic fragments, apparently of volcanic rocks. The oil just covers with a thin brownish film a triangular pool of water about two feet long by half a foot wide, and amounts therefore to extremely little. For about ten yards up stream oil issues from the breccia for the space of a foot above the edge of the water of the brook; and at the upper end of the ten yards the breccia is exposed to some 20 feet in height, overlain by some 20 feet more of greenish-gray soft sands and light brown sands with perhaps some more breccia fragments in a thick band below the middle. For the next eight yards up stream the breccia at the water's edge is covered with rubbish; but for ten yards further up the oil covers the surface of the breccia for two feet from the edge of the brook and for 15 yards still further, to the upper end of the exposure, reaches to about three feet above the water.

The only other oil place is 400 yards N. E. of the main well and no doubt on the outcrop of the same bed of rock and 100 yards above the second mentioned place, and has one oil spring, a hole about four feet long by two wide and three-quarters of a foot deep, full of water covered with a thin brownish black film of oil. Gas rises in large bubbles at one corner and at the opposite end and in small bubbles at another point. The hole is at the foot of a steep bank and cliff, where soft greenish-gray sand rock

with here and there half foot layers and thinner of small (filbert size) breccia. Above the spring there is no sign of oil in the rock and the alluvium below seemed at the time to be the source. About five yards down stream and five yards further from the brook there is a somewhat separate part of the cliff where we found a couple of imperfect fossils (shells ?).

The whole yield of oil then at the time of the survey (October, 1873) was only some two gallons (5 sho) a day. A hearsay report has reached me that further trials were made in 1874, and a daily yield of fifty gallons a day obtained; but I know nothing whatever as to how exact the statement may be. No asphalt was noticed near the wells.

6. *Working the Oil.*—Neither the yield observed by us nor even the rumored result of the trials made through the whole of last season give very much encouragement to further efforts; although the lands are evidently much richer in oil than any others in Yesso. If, however, it should be desired to make more trials our present map would be a guide, and the search for the oil-bearing beds would not be wholly at random, as it has been hitherto. The outcrop of the rock bed that bears the oil of the Main Well seems to run with many small irregularities, S. S. W. from that well, in the same general course as the Brook and mostly very close to it, for about two thousand feet. Then for another two thousand feet with a gentler dip as it approaches the axis of the basin or synclinal, it runs more southerly and then south-westerly rising to the crest of a high ridge 380 feet above the sea; and then turns northerly across the Brook towards the sea shore probably making an ess shaped curve before arriving there near the Ombi limestone. The precise place of the outcrop in this distant portion is, however, owing to the absence of rock exposures, much less certain than

along the Brook; a matter of no very great practical importance, because the bed seems to be rich in oil only near the Main Well. Doubtless the presence of oil in so long an outcrop along the Brook above the well would, if it really existed, have made itself known either to our surveying party or to the inhabitants who know so thoroughly almost every foot of ground and are so ready to take notice of every peculiarity in the appearance of the rocks or soil. The outcrop of the same bed in the other direction from the Main Well seems to run, with small irregularities again, north-easterly along the steep hillside easterly of the Brook until it reaches the middle oil place; and thence with a much gentler dip to turn more easterly and rise to the top of the broad flat topped hill some 220 feet above the sea, and there to pass over the axis of the saddle or anticlinal; and then to run in a general south-southeasterly course, not far from parallel to the sea shore, but about half a mile from it. The precise place of the outcrop here also, so far removed from exposures of the bed or even of other rocks, is much less certain than on the brook; but is not of so much importance, as there is no probability of any rich yield of oil here where all signs of it are wanting. Nevertheless the general course of the outcrop is probably well enough known to serve as a guide in searching for oil by digging or boring. It is very possible that the same outcrop runs more or less directly to the spot where there is a smell of oil gas in the Torizaki valley about two miles above the mouth of the stream, and perhaps a little further in a straight line south-southeasterly from the mouth of Washinoki Brook.

The outcrop of the other (upper) oil-bearing bed of rock is in general about parallel to that of the lower or main bed; and on the easterly side of the axis of the saddle would perhaps be somewhere about five hundred feet

distant from it towards the sea. On the westerly side of the axis (which passes very close, on the east, to the lowermost oil place) it runs first southwesterly along by the brook and its easterly bank for four hundred yards to the next oil place. Thence it runs south-south-westerly chiefly on the hill side to the west of the Brook, about 250 feet north-westerly from the outcrop of the lower bed; until after reaching the axis it turns northerly towards the sea going in general perhaps 100 yards, easterly of the outcrop of the lower bed.

Trial pits along the outcrop would not only test the merits of the oil-bearing beds, but if they were at all productive would determine still more exactly the place of the outcrop; and enable borings to be made on the beds with greater certainty as to the depth at any given point. But the map already shows with some degree of exactness the depth at which each bed may be found; and especially in what portions of the field it is to be found at all below ground, and where it has been wholly cut away in the shaping of the hills by the streams, the rain and the weather. It cannot be supposed that the effect of these agencies could have been much influenced, if at all, by the amount of oil in any part of the bed; so that the richness of any portion has no relation whatever to the present place of the outcrop. It would therefore be absurd to expect to find the bed richer at a great depth than it is near the outcrop.

If however the trial of the outcrop should turn out encouraging enough, borings might be made on the beds where they lie at a depth of a hundred feet or less, by hand, without very great expense. If the yield of such wells should prove to be good enough to pay for their cost and give a profit besides, it would perhaps be worth while to bore holes where the bed is still deeper, and to use for that purpose heavier and somewhat more compli-

cated machinery worked by horses or other animals, or possibly even a steam engine. The wells would be deeper and deeper the further from the outcrop: along the Brook near the main well about 100 feet deeper for every 36 feet of distance northwesterly from the outcrop; on the easterly side of the axis of the saddle perhaps 100 feet deep for every 220 feet of distance north-easterly from the outcrop; and on the westerly side of the basin perhaps 100 feet deeper for every 63 feet of distance easterly from the outcrop. On the axis of the basin or synclinal the depth would increase by perhaps 100 feet for every 375 feet of distance northerly; and on the axis of the saddle or anticlinal, by perhaps 100 feet for every 220 feet of distance northerly.

6. *Limestone.*—At a spot called Ombi, about three quarters of a mile north-westerly from the mouth of Washinoki Brook, some gray limestone rather impure looking with clay is exposed on the sea shore. The rock beds there form a narrow basin which seems likely to be the same as that on the Brook half a mile south-westerly from the Main Well. A block of limestone a foot long was also found on the Brook about three quarters of a mile south-westerly of the Main Well, and no doubt a bed of lime rock crops out somewhere near, though it was not found. The strike of the rocks there and at the Ombi limestone makes it seem very probable that both exposures belong to the same bed. In that case, the lime rock underlies the lower oil-bearing bed at a depth of about 300 feet, and has a very long outcrop that runs not only from the sea shore to the Brook exposure but still somewhat further inland; then turning north-easterly again crosses the axis of the basin outside of the curve of the oil bearing beds and passes nearly parallel, in general, to the out crop of the lower oil-bearing bed and goes over the axis of the saddle inside the curve of that bed;

and thence runs south-south-easterly at some three quarters of a mile further inland than the outcrop of the same bed. The lime rock at Ombi is so impure that perhaps only four yards in thickness would be workable. Even that is somewhat impure, but may make strong lime. There are besides some half-a-dozen feet in thickness of shales that look limy. Four yards in thickness with such an outcrop as already described, about four miles long within the limits of the survey, would contain about 86,000 tons within five yards of the surface. In spite of the rarity of lime-stone in this part of Yesso, it is not likely that it would ever pay to work the bed to a much greater depth, if even so deep, especially as it is separated by shales into several layers some inches or even feet distant.

7. *Mineral Water.*—The Yunosaki Mineral Spring mentioned in my report of 25th December, 1873, is 500 yards northwest of the mouth of Washinoki Brook, and about 40 yards from the sea and some 30 feet above it on the hill side. The spring is merely in the alluvial surface earth and is so small as to be curbed with a little tub; and the flow of water seems to be very slight. There is a little reddish iron rust before the spring where water has been spilt. The water is cold, free from gas bubbles and is not drinkable for it has a very sharp taste like copperas and burns the tongue. Nearly opposite the spring there are for 17 yards along the beach very numerous little springs where water bubbles up through holes an eighth or a quarter of an inch in diameter in the sand. The water is cold and tastes only of the sea salt which overflows it at every wave.

8. *Shipment.*—There were no roads at the time of the survey near the oil exposures, except the one along by the sea shore, but either bridle paths or wagon roads could easily be built up the valley of the Brook about

nine-tenths of a mile (one-third of a ri) to the Main Well; and even beyond, if oil should be found at new places. The oil could be carried from the mouth of the Brook either by the present bridle path or by some future easily built wagon road about a ri to Mori, whence it could either be shipped on vessels from the wharf or be carried by the new wagon road to Hakodate. In fair summer weather the oil might even be loaded with the help of small boats upon vessels lying off the exposed shore of Washinoki.

9. *Map.*—The map aims to show the shape and height of the ground and the probable place of the outcrop and sea level line of the two oil-bearing beds and of the limerock bed; and more fully the shape and position of the lower or main oil-bearing bed at other levels. The shape and height of the ground are shown by contour lines drawn at ten feet apart in level; those of the lower oil bearing bed by broken lines drawn upon it at 100 feet apart in level. It needs then but a glance to see what parts of the field are underlain by the bed and in what parts it would probably be quite useless to bore for oil. The upper oil bearing bed would have the same shape as the lower and its hundred foot contour lines would be about parallel to the lines of the lower bed. Adding the height of the ground above the sea to the depth of the bed below sea level at any point would give the full depth of a boring there.

The numerous stakes set up at the principal surveying stations which were levelled to get the height and shape of the ground were commonly 200 feet apart in straight lines; and such points are marked with a dot on the map and with the letters or numbers which distinguish them; so that it may be possible to find any point of the map on the ground, or any point of the ground on the map.

The structural axes of the rock beds are also marked

on the map, and the structure is further shown by a cross section drawn at right angles with them.

The surveying was done by Messrs. T. Yamauchi, T. Kuwada, J. Takahashi and T. Saito, Assistant Geologists, under very general instructions only. They plotted each their own lines and drew the topography; but Mr. Takahashi has had special charge of putting the whole together into one map with the needfull adjustments and copying. Mr. K. Makino traced the map with strong black lines on white cloth with a special view to photographing. You see that Mr. Takahashi has not yet finished the lettering but he will do so within a very few days, probably in ample time for the photograph to accompany the printed report. The whole of the final mapping has been done under my guidance, and the geological observations and mapping of the rock beds were my own.

I have the honor to be,

Sir,

Your most obedient servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer to the Kaitakushi.

Shiba, Yedo, 29th April, 1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

Sketch of the Nearly Finished Maps and Reports of the Geological Survey, by Benjamin Smith Lyman, Chief Geologist and Mining Engineer.

General Horace Capron,
Commissioner and Adviser to the Kaitakushi.

Sir

I have the honor to make the following report on the present condition of the maps and reports of the Geological Survey.

Besides the Maps already finished of:—

1.—Chatsunai and Shibui Harbors about 1.90 feet × 1.50 feet.....scale $\frac{1}{1000}$

2.—Ishcari and Otopchi Rivers 0.70 × 0.48... „ $\frac{1}{1000000}$

3.—Yamukushinai Oil Lands 1.12 × 1.12..... „ $\frac{1}{5000}$

4.—Idzumisawa Oil Lands 1.68 × 1.24..... „ $\frac{1}{5000}$

there are now maps in progress, and for the most part nearly finished of:—

5.—Washinoki Oil Lands about 2.00 × 1.82.. „ $\frac{1}{5000}$

6.—Sorachi Coal field (sketch) 1.16 × 0 98... „ $\frac{1}{12960}$

7.—Geology of Yesso in colors (sketch)
1.29 × 0.92..... „ $\frac{1}{2000000}$

8.—Kayanoma Coal Field about 3.80 × 3.15 scale $\frac{1}{5000}$

9.— „ cross sections „ 3.50 × 1.50 „ $\frac{1}{5000}$

10.—Poronai Coal Field „ 2.40 × 1.70 „ $\frac{1}{5000}$

11.— „ Cross sections „ 2.40 × 1.35 „ $\frac{1}{5000}$

12.—Noppaomani and Kawanai 3.53 × 3.53 „ $\frac{1}{5000}$

13.—Bibai Coal Field 4.74 × 2.60 „ $\frac{1}{5000}$

14.—Poronai to Noppaomanai 1.28 × 0.87 „ $\frac{1}{5000}$

15.—Kawanai to Ishcari River 9.50 × 0.60 „ $\frac{1}{5000}$

16.—Poronai to Horumui about 4.50 × 0.55 „ $\frac{1}{5000}$

17.—Makumbets Coal Field 2.50? × 1.20? „ $\frac{1}{5000}$

18.—Iwaonobori Sulphur
(?) about 0.70 × 0.40 „ $\frac{1}{5000}$

19.—Nuburibets and Oi
Lake sulphur (?) „ 1.00? × 1.00? „ $\frac{1}{5000}$

20.—Esan „ (?) „ 0.80 × 0.50 „ $\frac{1}{5000}$

21.—Kobui „ (?) „ 0.50 × 0.50? „ $\frac{1}{5000}$

22.—Okotsunai Iron
sand ..... (?) „ 1.25 × 0.75 „ $\frac{1}{5000}$

23.—Itashibeoni
sulphur..... (?) „ 1.25 × 0.75 „ $\frac{1}{1000}$

24.—Herashibets
River & Coal (?) „ 0.50 × 0.50 „ $\frac{1}{100.000}$

And Mr. Munroe says he has in progress the following maps of:—

25.—Toshibets Gold Field about 2.67 × 4.67 „ $\frac{1}{5000}$

26.—Reconnaissance of Toshibets River (sketch) ..... „ 1.33 × 1.67 „ $\frac{1}{100.000}$

27.—Kudoö Gold Field „ 2.25 × 3.33 „ $\frac{1}{5000}$

28.—Esashi Gold Field „ 1.17 × 2.33 „ $\frac{1}{5000}$

29.—Yurap Lead Mines (unfinished survey) „ 1.00 × 1.33 „ $\frac{1}{5000}$

30.—Musa Gold Field, Sheet No. 1, 1.83 × 3.50 „ $\frac{1}{5000}$

31.— „ „ „ „ 2, 1.83 × 3.50 „ $\frac{1}{5000}$

32.—Travels in Yesso (Sketch) No. 1, 1.83 × 2.50 „ $\frac{1}{400000}$

33.— „ („) No. 2, 1.33 × 2.00 „ $\frac{1}{400000}$

Of reports, besides those already printed of:

1.—The first season's work, dated 25th Dec., 1873.

2.—Yesso Coals, dated April, 1874.

3.—Geological Trip through Yesso, dated November and December, 1874

4.—Yamukushinai Oil Lands, dated 17th April, 1875.

5.—Idzumisawa Oil Lands, dated 26th April, 1875.

6.—Washinoki Oil Lands, dated 29th April, 1875.

there will be reports on:

7.—Sketch of the Geology of Yesso.

8.—Kayanoma Coal Field.

9.—Poronai Coal Field.

10.—Noppaomanai and Kawanai Coal Field.

11.—Bibai Coal Field.

12.—Makumbets Coal Field.

13.—Toshibets Gold Field.

14.—Kudoö Gold Field.

15.—Esashi Gold Field.

16.—Yurap Lead Mines.

17.—Musa Gold Field.

18.—Tokachi Gold Field.

There will also perhaps be at least three or four other brief reports, and, possibly, a few very small maps of special portions of the field work that has been already done but not yet fully enough reported on or mapped.

The sketch map of the Geology of Yesso is to show the observed and conjectured place throughout Yesso of the following rock groups:—

	Thickness in feet.
Alluvium (new) perhaps not more than ...	100?
Bluff deposit (or old alluvium)	100?
New Volcanic rocks	200?
Toshibets Group	3,000?
Old Volcanic rocks...	3,000?
Horumui Group	4,500?
Kamoikotan Group	3,000?

That seems to be in general their order according to age from newest to oldest. The Toshibets Group is both the Toshibets Karafto and the Horumui Karafto group of my report of 25th December, 1873; and seems to be the source of all the gold, oil and wood-like lignite that have been found. It has such recent looking fossils as to seem to be of middle or later Tertiary age. Its rock beds have however at times a dip about vertical though large spaces, as on the Horumui; but sometimes, as clearly seen on the Ishcari below Kamoikotan, suddenly change from such a long continued vertical dip to an equally wide spread nearly horizontal one. The Old Volcanic rocks include doubtless the Toshibets Kuril Group of that report and some of them are of granitic structure, syenite and perhaps even granite proper. The Horumui Group is the Horumui Kuril Group of that report of 1873 and contains all the coal beds. It is per-

haps of older Tertiary or possibly late Secondary age. The Kamoikotan Group takes in the blackish quartzites of Kamoikotan and the upper Ishcari together with their limestone and serpentine; also the impure limestone of Birô and the limestone of Garonosawa; and every where seems to be very highly metamorphosed. No fossils have been found in it any where; but it has the appearance of great age, at any rate much greater than that of any of the other groups, and was probably the first nucleus of the island.

In 1873 the groups had been examined only in the comparatively small southern part of the island of Yesso, and seemed to be well enough distinguished by the direction of their structural axes which appeared to be very uniform and strikingly parallel to the Kuril Islands, North some 50 degrees east (magnetic), and to Karafto (or Sagalin), nearly north and south. But on going through and around the rest of the island no such uniformity seems to persist; and the Horumui Group seems in the Akkeshi region near the eastern end of the island to have a general strike of nearly north and south; while the Old Volcanic Rocks near Sôya at the north end of the island seem also to have a general strike of about north and south; and these must undoubtedly be the rocks of the southern end of Karafto itself, where the north and south structure appears to be especially well marked.

No rocks older than the Kamoikotan Group seem to have been found any where in Yesso. Although pebbles of true granite occur at Birô, none has yet been found in place, so that its age is quite uncertain. All the syenite and other granitic rocks hitherto found in place are no doubt of Old Volcanic origin and therefore comparatively new.

In respect of economical Geology, coal continues to be

almost the only workable mineral yet known in Yesso. The Horumui (or Poronai) coal is no doubt a part of the same field with the Sorachi coal and the Noppaomanai and Bibai coal are connecting links between the two. It is not improbable that the coal rocks extend continuously eastward as far as to the Makumbets coal not far from Uragawa on the East coast. But although that coal is said to be the best of the several exposures known on that part of the coast, there seems to be, as in the Akkeshi region still further east, only one workable bed (or possibly two) and that only barely so. Nevertheless the Horumui and Sorachi productive field seems to be a large one, perhaps 25 miles in diameter; though hardly accessible except by the Ishicari River. Coal is said to have been found in place on the west of that river within two or three ri of Uraushinai; and though the coal on the Rurumoppe side of the mountains seems to be unworkable (as on the Herashibets), yet the numerous bits of coal at the mouth of the Uriu and other western branches of the Ishcari may lead to a field of some size including that Uraushinai coal; and perhaps reaching northerly to the neighborhood of the Ambeshinai branch of the Teshio River. The whole of the rest of the northern and northeastern portions of the island seems to be made up of volcanic rocks, chiefly old; while the centre and southeast are made up of the Kamoikotan Group, partly covered by new volcanic rocks; and around Akkeshi of unproductive coal rocks. There appears therefore to be no possibility of any future discovery of very useful minerals in those by far the larger portions of the island. The Itashibeoni sulphur already described may prove worth working there, but the Meakan sulphur is hardly likely to be so; and nothing else is even so encouraging as they are. Iron sand is found in traces at very many points on the coast, but nowhere anything like

so abundantly as at Okotsunai and Yamukushinai on the shore of Volcano Bay. Some bog iron ore was found last season near Sapporo but has not yet been properly examined either geologically or chemically. The carbonate of iron is found in small quantities and of poor quality at several places but is nowhere workable. Manganese, lead, zinc, copper and silver ores have not even been found in traces except at the places in the southern part of the island reported on in 1873, and none of them are workable.

Mr. Munroe has continued his examinations of the gold fields and his detailed report on them is almost ready. He gives now the following practical results :

" *Toshibets Gold Field* area .....9,674,000 sq. metres
" Area of main terraces, available for washing .....5,305,000 „
" Area of river bed and flood plain- difficult to wash..... 200,000 „
" Area of poor ground (by difference) including high terraces and terrace slopes ..... 169,000 „
"Area of old workings—(estimated) some 160,000 sq. metres (to be deducted from the area of main terrace).
" Area of tributary valleys, containing little or no gold—omitted.

" Average thickness of gravel (data imperfect) some 3 metres.

" Average value of gravel, giving greater weight to results representing larger areas 5 *sen per cubic metre* ; poor ground 2 *sen*.

" *Kudoö Gold Field* area.....1,528,000 sq. metres.
" Average thickness of gravel, $1\frac{1}{2}$ metres .....2,292,000 cubic „
" Average value of gravel (as above)..$^{35}/_{100}$ of one *sen*.

"*Esashi Gold Field.*—area some 6 ri by about 1 ri, including both valley and intervening marine terrace.

"Value of gravel, $^{6}/_{100}$ of one sen. Thickness, perhaps, 2 metres.

"*Jimikishi.*—578,000 sq. metres; 1.8 metres thick; Value 1 sen per cubic metre.

"*Musa Gold Field.*—area .....7,976,000 sq. metres.

"Area of main terrace.....4,101,000 „

" " river bed and bottom land .....3,875,000 „

" „ high terraces, hill-sides, and tributary valleys omitted, poor.

"Average thickness of gravel 2.4 metres.

"Average value of gravel (calculated as above) $^{74}/_{100}$ sen per cubic meters.

"Area of old workings... 868,000 sq. m.
"Representing about.....1,500,000 cu. m. gravel.
"Now would be worth ... 21,000 yen in gold
"sand or would contain by weight, $9\frac{1}{2}$ kamme of
"gold"

"*Tokachi Gold Field*: area unknown: Thickness of "gravel some 15 to 25 metres; average value, $^{1}/_{100}$ of "one sen, and less!"

He adds in regard to the most nearly workable portions of the fields, only two in number: "The upper part of the Toshibets valley, with an area of about 1,000,000 square metres and an average thickness of gravel a little over three metres, will contain an average of $7\frac{1}{2}$ cents to the cubic metre, or about $5\frac{2}{3}$ cents to the cubic yard. It is of course possible that this will give a margin of profit if washed; but the profit will not be large. From this area should be deducted 20 per cent, at least to allow for ground already washed. An area of perhaps one or two thousand square metres 6 to 10 feet thick at the end of the main terrace near Yunoshiri, in the Musa Gold Field, will yield perhaps $8\frac{3}{4}$ sen per cubic metre or

$6\frac{2}{3}$ sen per cubic yard ; but there is no water convenient, and the gravel would probably have to be carried on pack horses (or in cars ?) one or two hundred yards."

There would therefore be in the Toshibets field about $180,000 of gold barely workable, and in the Musa Field about $400. It is satisfactory to have so definite a result of such a careful and thorough examination ; and it sets at rest all schemes for washing gold in Yesso on a large scale, which would undoubtedly have proved disastrous.

The maps have of course taken more time than they otherwise would on account of the total inexperience of the assistants. It has seemed best to let them aid in every part of the work even when it might have been done more quickly without their help and the numerous explanations required. For in that way they gradually gain such experience and knowledge of the principles involved as to become more and more able to work without special guidance. Indeed it is quite a boast of the survey that the Japanese assistants, though the first Asiatics to learn the practice of geology, are doing so successfully, and that in a few years they may become so far accomplished that they can make satisfactory geological surveys without foreign aid. But of course it is not to be expected that they should gain such skill more rapidly than a foreigner who has a much better education to begin with. They seem to have no exaggerated impression of their own proficiency and skill ; and above all they have learned habits of truthfulness, so especially essential in such work as theirs, and know the importance of careful exactness. They are therefore free from two of the greatest obstacles to their final success, which many incredulous foreigners have considered quite insurmountable in some parts of Asia. Much of the assistants' time in the winters has been taken from the

mapping by their daily lessons and by frequent illness and holidays.

Hoping now very quickly to hand in the remaining maps and reports, I have the honor to be,

Sir,

Your most obedient servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer to the Kaitakushi.

Shiba, Yedo, 4th May, 1875.

GEOLOGICAL SURVEY OF HOKKAIDO.

SKETCH

OF THE

NEARLY FINISHED

MAPS AND REPORTS

OF THE

GEOLOGICAL SURVEY,

BY

BENJ. SMITH LYMAN,

CHIEF GEOLOGIST AND MINING ENGINEER.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

LETTERS

ADDRESSED DURING THE YEAR

1875,

TO

KURODA KIYOTAKA,

Kaitaku Chokuwan,

AND

HORACE CAPRON,

Commissioner and Adviser.

TOKEI:
PUBLISHED BY THE KAITAKUSHI.
1875.

CORRESPONDENCE.

[TRANSLATION.]

Tokio, Kaitakushi, 14th of 4th Month,
Anno, 8th Meiji.

GENERAL HORACE CAPRON,
Commissioner and Adviser.

DEAR SIR,

I beg to reduce to writing, what has been said to you lately by Nishimura Chuhangan, as follows:—

Since you have been here acting as the Commissioner and Adviser to the department, there have been received from you many communications containing valuable advice, relating to the important work for the development of Hokkaido, and we, acting more or less upon the pressing importance for their immediate execution, many of these works have been carried out, whilst some still remain to be executed.

As three years have been now passed, and you have been so well acquainted with the real state of affairs in that Island, it is very desirable that you should point out to me those most practicable and necessary for immediate development.

By summing up all the subjects heretofore advised showing their leading points, and arranging the different

subjects under their proper heads, designating those most important from those which may be deferred to a future period you will much advance our interest.

In addition to your suggestions lately made in reply to my inquiry in reference to the mining and other enterprises, and the rules and regulations for the admission of foreign skill and capital into the Island, I should like to have for future reference, a history of the laws and regulations enforced under the British system for the Government of foreign settlers in Australia and India &c, which you will kindly study and submit to me.

If any omission in your former reports on certain regulations for foreign immigrants into the United States, should occur to you, it is also very desirable that you should report them to me.

Very respectfully,
Yours &c.,
KURODA KIYOTAKA,
Kaitaku. Chokuwan.

TOKIO, April 30th, 1875.

His Excellency
KURODA KIYOTAKA,
Chokuwan, &c., &c., &c.,
Tokio.

SIR,—I have the honor to acknowledge the receipt of your letter of the 14th instant, requesting an epitome of the reports and letters which I have had the honor to submit from time to time to this Department as its Commissioner and Adviser, with an arrangement of the various subjects upon which they treat, separating those of lesser from those of more importance. Your Excellency, in anticipation of my early departure for America, also solicits any further suggestions which may appear to be practicable and desirable for future reference in the

development of the resources of Yesso, requesting, in addition, a summary of the laws of Great Britian regulating foreign immigration to Australia, New Zealand and India, together with an explanation of the mining laws of those countries and of the United States &c., &c.

Your Excellency's enquiries cover a wide field of research, and in order to make my reply in any degree intelligible or applicable to the purposes Your Excellency has in mind, there must, necessarily, be undertaken an amount of labor and investigation, which the brief time left at my disposal and the limited sources of information at my command naturally cause me to shrink from encountering. However, Your Excellency's great personal kindness on the eve of my separation from this Department and departure from Japan, prompts me to do what I can to advance the interests of the Department and to aid your individual labors.

It is scarcely necessary to review here the past labors of the Department. They are extensively commented on in my reports and letters, reference to which will sufficiently explain my views. I should, however, fail to meet Your Excellency's request to speak without reserve, if I hesitated to express the conviction that past experience teaches the necessity of a more rigid scrutiny of the plans and schemes submitted for Your Excellency's consideration, involving, as they often do, the expenditure of large sums of money by persons who can have at the best but a superficial idea of the proper methods of carrying them, practically, into effect. It cannot be expected that those who have no practical, nor even theoretical, experience of an undertaking, can gain from a fragmentary conversation or from a glance at a chart or plan such knowledge as will enable them to comprehend it in all its details and to carry it out to successful completion. Mistakes of this character have, in my opinion,

produced most unfortunate results for the Department. Experience may thus be gained, but it is at a ruinous cost. The better way would be defer to the skill and experience of the person who is employed to give advice, and hold him responsible for results.

The necessity for strict compliance with Your Excellency's request in your letter of the 14th inst., that I should point out the most important and practicable measures for the development of Yesso, and that I should sum up, under appropriate headings, the advice I have heretofore given &c., &c., is somewhat lessened by the printing of my reports and of so much of my correspondence as is necessary to illustrate the views I have entertained and expressed and the plans to which I have given my sanction.

My suggestions contemplated a systematic plan of operations, which, had it been strictly carried out, would, I feel convinced, have given more general satisfaction than the course adopted. Many important works, essential to the general plan, have been suspended ere they were finished, and the funds for their completion diverted to the promotion of schemes of doubtful utility. In contemplation of such a contingency, I used the following language in my report of January, 1872 (General Report, page 47) : "Such funds should not be diverted to any side "issue or for the support of a large supernumerary force, "which will serve rather to retard than to advance the "main purposes of the enterprise."

On page 101 of my General Report and in subsequent communications will be found a detailed plan for the settlement and development of Yesso, which, thus far, I have seen no reason to change in any particular.

I will proceed to consider in detail the various suggestions contained in that report.

Geological and Mineralogical Survey of Yesso.

The progress made in this, the first of the series of projected works, may be seen by reference to my General Report, pages 66, 67, 79, 80 and 102; also to the reports of Mr. Benjamin S. Lyman, pages 117, 327, and to that of his assistant, Mr. Henry S. Munroe, page 165. These reports are accompanied by maps and charts, and furnish much valuable information as to the geological formation of the island and its mineral resources.

Trigonometrical and Hydrographic Survey.

The report of James R. Wasson, Esq. on the preliminary trigonometrical survey of Yesso (General Report, page 213) and the report of Lieut. Murray S. Day U.S.N. on the hydrographic survey of the Ishikari (page 203) with the report of the continuation of the surveys under Lieut. Day (page 281), are valuable, as they supply important information as to the sea coast and navigable waters of Yesso.

It is to be regretted that all the maps furnished by these gentlemen cannot be completed in time for publication in the General Report. Those which appear were lithographed by Japanese assistants in this Department, and are among the the first, if they are not the first, attempts at lithographing made in Japan.

The importance of the continuation of these, the first, systematic surveys ever undertaken in Japan, cannot be too strongly urged. Whatever may be the future policy of this government, whether it be one of exclusion or one inviting the entrance of foreign skill, capital and labor to aid in the developement of the island, these surveys will be found equally useful, if not indispensable.

The Enactment of suitable Laws for the Government of Yesso.

In a lengthy communication dated the 10th of March, 1874, I replied to Your Excellency's enquiries of the 4th

of the same month as to the General Municipal Laws of the United States, the rules for the management of institutions for the deaf, dumb, blind, poor &c., and the possibility of their adoption in Yesso, which letter will be found in my General Report, page 229. Letters on the same general subject will also be found on pages 567 and 585.

It is needless for me to say more on this subject than to express the conviction that upon the enactment of judicious laws depend the future prosperity and progress of Yesso. The question is one which should command the attention of your most able men.

The Construction of Good Wagon Roads.

There can be but one opinion as to the importance of this subject. Good thoroughfares, whether by rail or wagon road, are equally essential to the prosperity of an old country and to the development of a new one. No country has had greater experience in this direction than the United States, and I do not hesitate to say that no improvement of any magnitude in that country ever preceded the construction of railroads or good wagon roads. It is my opinion that every attempt to develope the resources of Yesso without first providing good throughfares, will fail. The creation of towns along the coast by large expenditures of the public funds without a surrounding country made easily accessible by good roads, must surely fail of good results. The Japanese Government cannot hope to establish a prosperous civilization in Yesso by merely dotting the coast line here and there with villages which are practically as distant from the country whose resources should add to their growth and prosperity, as though separated by the antipodes. One might as reasonably expect to gain a warm and comfortable dwelling by merely chiselling the face of a cliff into the semblance of a house front. Roads are the veins and

arteries of a country, and without them there can be nothing but artificial life.

The roads in Yesso should no longer remain in the unfinished condition in which they now are, but should be macadamized, furnished with good bridges and rendered serviceable the year round.

Allusions to this subject will be found upon pages 45, 53, 61, 62, 84, 93, 103, 141, 245, 247 and 269, of the General Report, and in my unpublished letter of August 30th, 1874.

Cheap Transportation.

This subject naturally follows the consideration of the establishment of roads. It is, moreover, intimately connected with the general commercial relations of Yesso with other portions of the Empire.

The best facilities should be extended to immigrants to Yesso, transportation at the cheapest possible rates among the first. The main obstacle to-day to immigration to Yesso and to profitable trade in its production is the lack of cheap and reliable transportation, not only in the interior, but also to the markets of China and Japan, where the demand for productions abounding in the island is great and increasing, which demand is at present supplied mostly from far distant countries.

I would earnestly direct your Excellency's attention to this subject and beg to refer you for what I have already said with reference thereto to pages 62-65 and 82-84 of my General Report.

Minerals, and the means to be adopted for their utilization.

Thus far the surveys of Mr. Lyman have exposed no very large deposits of valuable minerals, with the exception of coal, lime and sulphur.

Of coal the quantity is large and the quality good.

The discovery of iron has, thus far, been confined to a few beds of sand ore. For more minute information I beg to refer Your Excellency to the reports of Messrs. Lyman, Munroe and Blake at the following pages :

Coal; pages 134, 139,165, 169, 173, 199, 334, 342, 402, 421, 524 and 527.

Iron Sand; pages 16, 58, 139 and 143.

Sulphur; pages 5, 143, 148, 470 and 473

Limestone; pages 148 and 650.

Gold; pages 5, 8, 10, 150, 152 and 401.

Oil; pages 13, 152, 155 and 593.

Mineral Water; pages 155 and 160.

Silver; pages 126 and 127.

Lead; pages 5, 6, 7, 13, 126 and 127.

Zinc; pages 126 and 127.

Manganese; page 127.

Copper; pages 8, 126 and 127.

Gypsum; page 126.

Orpiment; page 126.

The largest deposits of coal seem to be on the west coast at Chatsnai in the vicinity of Iwanai, and in the interior on the Toshibets and Horumui rivers, tributaries of the Ishikari, about twelve miles distant from the navigable waters of that stream and about the same distance from Sapporo.

The most important questions for Your Excellency's consideration in connection with the coal interests of Yesso, are, First, *the opening and working of the mines so as to gain the largest net revenue possible to the government;* and, Second, *the selection of the most direct and the cheapest way of getting coal to market.*

I am of opinion that the first of these objects can be most readily attained by the aid of private capital and skill, both native and foreign, under a system of royalties paid to the Government.

I beg to refer to my first report to the Department (General Report, page 44), and to pages 78, 99, 103 and 261 of the same volume.

With reference to the second question I would respectfully call Your Excellency's attention to pages 62, 78, 93 and 103 of the General Report and to my various unpublished communications on the subject.

I have from the beginning considered it of the utmost importance that communication by rail should be had between the large coal deposits in the Ishikari valley, and the Pacific Ocean, thus at the same time connecting Sapporo with the other portions of the Empire and affording an outlet for the large quantities of lumber in the valley and, at no distant day, for its surplus agricultural productions.

The circuitous route by way of the Ishikari river, Japan Sea and Straits of Tsugaru, long, dangerous and expensive, requiring many trans-shipments en route and closed for one half the year by ice, will never supply the demand for cheap, safe, direct and uninterrupted communication such as the route by the way of Mororan offers.

Gold.

Mr. Munroe's surveys of the gold fields have not resulted in any very encouraging prospects. There are gold indications both on the eastern and western coasts, but the metal does not appear to be in sufficient quantities to ensure its profitable working.

The Utilization of Surplus Lumber

also deserves Your Excellency's especial attention. Great loss occurs annually by reason of decay. Care should be taken to cut out the fully matured trees, leaving the thrifty ones to grow and supply the loss. The waste each year is immense, but it might be turned to account by proper management. Preparations have been made at

Sapporo with a view to the beginning of a trade in lumber; saw mills and valuable machinery have been erected, and the only thing that remains to be done is to put the business under systematic and efficient direction. The machinery is of the best and works to perfection when it is allowed to run. The most important thing is to *let it run.*

There is a growing demand both in this country and in China for lumber which is largely supplied from America. The lumber of Yesso can be made a source of much direct revenue by shipment to these near markets, access to which can be made a matter of a few days only.

In connection with this subject, I have the honor to refer to pages 64, 65, 70, 74, 76, 93, 104, 247, 264, and 296 of my General Report.

Fisheries of Yesso.

By reference to pages 101 and 105 of the General Report and to my article on the fisheries dated January 24th, 1875, page 567, Your Excellency will be possessed of my views in regard to this important matter.

Farms and Nurseries.

The flourishing condition of the farms and nurseries of the Kaitakushi, and the entire success in the introduction of improved breeds of domestic animals, and in the growth of foreign grains, fruits and grasses, both in this island and in Yesso, afford most encouraging results and give promise of beneficial effects in the future.

The importance of these farms and nurseries to the country at large can hardly be overestimated. Improvement in the character and increase in the varieties of agricultural productions mark the rise of a nation in the scale of civilization. Agricultural interests underlie all others. As the scope of a country's agriculture is widen-

ed, its products diversified and improved, and the methods of their cultivation simplified and cheapened, the prosperity of the country at large will be heightened. Other branches of labor will keep pace in progress, and new industries will spring up.

The nurseries and farms of the Kaitakushi are the germs of great results, and I feel confident that in the not distant future they will give ample proof of their great value. It has always been a favorite wish with me that there should be established in connection with the nurseries of the Kaitakushi an *arboretum*, or collection of native and foreign trees and shrubs arranged according to genus and species. This desire, however, has not been sufficiently appreciated by the officials immediately in charge of such matters to enlist their co-operation. But a small beginning has been made; choice plants from America and France have been imported and are highly appreciated by the Japanese, whose taste for the beautiful in nature is proverbial.

In this connection I beg to refer to pages 46, 49, 60, 67, 68, 69, 86, 87, 101, 105, 249, and 266 of my General Report and to my letter of the 29th September, 1874, page 269,

There is one matter which should receive Your Excellency's attention, viz: the plan of a well devised and cheap structure for the residences of the poorer settlers in Yesso. These people, unused to the cold climate of Yesso, should be effectually protected from the rigors of winter. The buildings erected in foreign style at Sapporo will serve the purpose when they have been supplied with chimneys and fire-places for burning wood, which is there very cheap fuel.

I have repeatedly advised that Yesso should be opened to foreign capital and skilled labour, and I am thoroughly convinced of the fact that such a course would of all things

serve best to promote the speedy settlement of the island and development of its resources. For my views on this subject I would respectfully refer to page 48 of the General Report and to my communication of the 20th March, 1875.

With reference to Your Excellency's request to submit for your consideration a summary of the laws enforced under the British system for the government of "foreign immigration" to India and Australia, I have the honour to reply that there has been no uniform system for the government or colonization in either of those countries. India was never, in the proper sense of the word, colonized by the English, while the history of English colonization in Australia, has not been the result of a plan adopted from the beginning, but has been marked by a series of enactments which have not only had no connection with a general systematized plan, but have been, on the contrary, often directly opposed to each other.

It is well perhaps to remark at the very outset that the example of British rule in India presents but little worthy of imitation by the government of Japan in its endeavor to develope and utilize the resources of Yesso. In addition, the circumstances of the two countries are so wholly dissimilar that no instructive parallel can be drawn between them.

The English first occupied India in the capacity of traders. The foothold gained by them was insecure at the best. They maintained a few trading posts upon the coast, and endeavored to obtain the favor and patronage of the native princes by proffers of friendship and even by protestations of fidelity and allegiance. From the beginning English interests were wholly under the control of monopolies, and finally up to 1858 under the exclusive control of the East India Company. The object of this corporation was not the settlement

of the country nor the development of its resources, but simply its own aggrandizement and enrichment by means of trade. It is true that in time as the monopoly increased in strength and wealth, the scope of its aspirations was widened until its ambition could only be satisfied by the acquisition of kingdoms, the overthrow of princes and the maintenance of armies and a regal style of Government, but I feel confident that I shall be borne out by history when I assert there was nothing in the means by which this power was acquired of which Great Britain can justly be proud, or by imitating which Japan can profit.

The system of land tenure existing in India at the time of the advent of the English was that established by the Mogul rulers. Lands were held by ryots, or small farmers, who had an hereditary right to the land they occupied, for which they paid the Government a tax which was supposed to be in direct proportion to the assessed value of the land. But the British rulers of India, imbued with profound faith in that system of land tenure which is to-day the greatest curse of British civilization, determined to create a class of landlords to whom the ryots should be tenants. Accordingly they vested in the zemindars who had previously been only tax gatherers, the ownership of the districts from which they had formerly collected taxes. This ownership was subject only to a fixed tax to be paid to the Government, while the zemindars in turn collected taxes from the ryots for the use of the land. The results of such a policy might easily have been foretold. The "landed-gentry" thus established were rapacious in the extreme; the Government taxed them, and they taxed the poor cultivators of the soil to the verge of ruin. In those days it was a favorite saying with the native that a "Hindoo has nothing left, but "his skin." In the words of a distinguished English

political-economist, "The measure proved a total failure." Unhappily it was more than a failure to the poor farmers whose protection should have been one of the first cares of the Government,

In some portions of India the ryots were allowed to take their leases directly from the Government. But even with this more enlightened policy, the agricultural interests of India have not prospered, while her manufactures have deteriorated or disappeared altogether. The time was when India supplied a great part of the world with cotton cloth. Now England supplies India. The policy of England will not allow competition with home manufactures in any country over which she has control.

From the cultivation of cotton most of the agriculturists of India turned to the cultivation of opium, and the ruinous effects of the change are evidenced by the present wretched condition of the cultivation of the soil. With abundance of rich bottom land at hand, which only needs drainage to render it fit for use, the farmers of India cultivate the higher and poorer lands where no extra outlay is required. They depend on the year's crop for the year's scanty supply of food, and failing that, famine sweeps them away by the thousand.

The first British Colony in Australia was settled at New South Wales in 1788. It consisted of 850 convicts guarded by 200 soldiers under command of Capt. Phillip. The object of the English government in establishing this colony may reasonably be presumed to have been not so much the settlement of the island as to get rid of its convicts. The peaceful disposition of the aborigines and the remoteness of Australia from the mother country, were undoubtedly the reasons for the step. There were no laws or regulations for the government of the community thus formed, but everything was left to the discretion of the governor, who practically had control of the lives and

property of the colonists. However other portions of Australia presented a more inviting aspect, and it was not long before free colonists began to flock to its shores.

The colonists were granted land by the government in different amounts, but no system of land laws was instituted. Military men and officials received extensive grants; free laboring settlers received grants limited to a few hundred acres in proportion to their means and the number of their families, and discharged convicts received small grants to enable them to support themselves. In time, however, land became more valuable, and grants were discontinued and a system of purchase substituted. Land was sold after survey in quantities to suit purchasers and at a reasonable price. But this wise system did not meet the views of an influential class in Australia. The capitalists and large wool-growers did not favor the creation of an independent, self-supporting class of small land-holders. By means of their representations another system of colonization was instituted and new land regulations were made. The price of land was raised so that poor men could not purchase. Large tracts, however, were let out at merely nominal rents to rich graziers. All moneys obtained from this source were expended in the advancement of colonial interests, in public works, local improvements &c. But in 1853 the control of the land was given to the colonies by the home government.

I should err, in my own judgment, if I failed to impress upon Your Excellency's attention the fact that Australia can hardly be taken as an example for the guidance of the Japanese government in its work in Yesso. The circumstances governing the colonization of the two islands are so dissimilar that no fair parallel can be drawn between them. Australia was at first merely a penal colony. For a number of years the presence of convicts was a

source of great embarrassment to the local Government and of much annoyance to the free settlers. The island derives its principal wealth from stock raising and from its gold. Its immense plains are adapted to the growth of sheep and cattle to an extent a tithe of which Yesso could never hope to gain with the pasturage it possesses. The discovery of gold, also, added greatly to the wealth and prosperity of Australia. Under the anomalous circumstances which attended its colonization, it has advanced rapidly, but that advance has been rather the result of good fortune than of foresight.

In compliance with Your Excellency's additional request as to the laws governing the disposition of lands in the United States, to which I have already alluded in my General Report (pages 48 and 49,) I take pleasure in submitting a brief synopsis of the manner of surveying, transferring and otherwise disposing of public lands in the United States.

Affairs pertaining to the public domain are regulated by the "Land Office," which is under the direction of a "Commissioner."

The public lands are divided into districts, in each of which there are two officers the "Register" and "Receiver." The districts consist of such amounts of land as may be readily controlled from one office. The duty of the Register is to record the sales of land and the amounts received therefor. The Receiver, as the title of his office indicates, has charge of the funds received in payment for lands, and also has charge of public auctions of land, &c. In each convenient number of districts there is an officer styled the "Surveyor General," who is charged with the direction of the survey. The territory is divided into "ranges," "townships," and "sections." A township is six miles square and is divided into thirty-six sections of one mile square each. A township con-

tains 23,040 acres and a section of 640 acres. The sections are subdivided into halves, quarters and eighths. The ranges, township and sections are numbered in order, fractions being numbered as if they were whole. By this means confusion is prevented, and the exact locality of any claim can easily be determined by a glance at the map arranged in this matter.

Any person, the head of a family or over twenty-one years of age, may register in the land office, upon the payment of a fee of ten dollars, his intention to take 160 acres or a quarter section of land, in any locality that may suit him and which is not already occupied. Taking possession of his land, he must erect thereon a comfortable dwelling and must live there five years. Upon proof of having complied with these conditions, he shall become the owner of the land and shall receive from the Government a "patent" or deed therefor.

Failing compliance with all or a part of the above conditions the settler may still become bona-fide owner of the land he occupies, by payment to the Government at the rate of $1.25 per acre for the poorest and $2.50 per acre for the best land.

Public lands are also disposed of at public auction for cash, in which case the price must at least exceed $2.00 per acre.

But the Government of the United States reserves to itself a special control of mineral lands within the public domain. They are not disposed of with the same facility as other lands. Different portions of the country are governed by different regulations in this regard. It may be stated in general that mineral lands can never be preempted in quantities exceeding 3,000 square feet. They are frequently sold at public auction and are as frequently held by the Government until something proportionate to their value can be received for them.

The object of this caution is evident. It is not right that the government should part with its most valuable property at a mere song, and regulations are framed expressly to avoid this result.

From this brief summary Your Excellency will perceive that the land laws of the United States are so framed as to encourage colonization. They were enacted for the benefit of no class, but were intended to attract to our shores those hardy settlers whose frugality and industry are the surest pledges of the prosperity of their enterprises. The complete success of these laws is their highest praise.

I have the honor to submit the foregoing remarks to Your Excellency, and trust that, imperfect as they necessarily are, they may meet with Your Excellency's approval, and may serve as an answer, in part at least, to Your Excellency's enquiries.

I have the honor to be,

Very truly yours,

HORACE CAPRON.

GEOLOGICAL SURVEY OF HOKKAIDO.

THE

GOLD FIELDS OF YESSO.

A REPORT

BY

HENRY S. MUNROE, E.M.,

Professor of Geology and Mining in the Imperial College, Tokio; and formerly, Assistant Geologist and Mining Engineer to the Kaitakushi of Hokkaido.

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TOKIO, JAPAN, 17th May, 1875.

GENERAL HORACE CAPRON,

Commissioner and Adviser
to the Kaitâkushi.

SIR:

I have the pleasure of transmitting to you the careful and elaborate report of Mr. Munroe on the Gold Fields of Yesso; and have the honor to be,

Sir,

Your most obedient Servant,

BENJ. SMITH LYMAN,

Chief Geologist and Mining Engineer
to the Kaitakushi.

TOKIO, JAPAN, May 10th, 1875.

Mr. BENJ. S. LYMAN,
Chief Geologist of Hokkaido.

SIR: I have the honor to report the following results, obtained in the examination and survey of the more important Gold Fields of the Island of Yesso. This report includes the detailed results of the gold-washing, and of the topographical surveys, with an outline of the geology of each field. A more complete description of the characteristic rocks, with the thickness and arrangement of the different beds, will be given in another place.

The report also includes the results of the examination of numerous so-called copper, lead, and silver mines—visited incidentally while traveling from one gold field to another.

Respectfully submitted,

HENRY S. MUNROE.

THE TOSHIBETSU GOLD FIELD.

THE TOSHIBEṬSU GOLD FIELD.

This gold field is situated on the head-waters of the Toshibetsŭ, or Toshi river, which empties into the Japan Sea, between the small towns of Setanai and Fŭtoro, in the province of Shiribeshi, on the west coast of southern Yesso. The gold field, however, is in the province of Iburi, and is most easily reached from the east coast; by leaving the shore of Volcano Bay at Kunnui, and following the valley of the Kunnui river; from the head of which a road, or rather bridle-path, leads across the hills to the Toshibetsu.

The Toshibetsu, in this part of its valley, flows between high hills, about one thousand to twelve hundred feet above the sea, or eight to nine hundred feet above the river.

The bottom of the valley lies in three, or in some places four, distinct terraces; respectively twelve to fourteen feet, thirty to fifty feet, eighty to ninety feet, and two hundred and fifty to two hundred and seventy feet above the river. These terraces are remarkably uniform, falling in level with the fall of the river, and keeping

always about the same relative height to each other, and to the bed of the stream.

The lowest of the terraces is formed entirely of gravel, with a covering of sand and clay, the bed-rock being often below the level of the stream.

The next two terraces are covered with gravel, apparently deposited by running water, usually about nine to twelve feet thick, and covered by several feet of yellow sand and soil. The bed-rock is far above the present level of the stream, seeming to indicate a recent elevation of the land in this part of the island, and a consequent deepening of the valley by erosion.

The highest terrace is also covered by gravel, perhaps thirty or forty feet thick, and overlaid by fifty feet of yellow sand and clay. Neither the gravel, nor the bed-rock, are anywhere well exposed, so that these measurements are somewhat approximate. Even the presence of gravel was only discovered by digging for it.

Before entering upon the details of the work of the survey, it may be well to give an outline of the geological relations of the rocks found in the valley. These rocks may be divided into four groups. Arranged with the newest first, we shall have.

1*st. Alluvial or Terrace formations.*—Including the auriferous gravels with their overlying beds of sand and clay. These beds of gravel, both of the river plain and of the higher terraces, have been deposited in running water, as before noticed; which fact is shown by the arrangement of the materials, and particularly by the position of the imbedded flat stones, which overlap one another, being uniformly inclined, and having their lowest edge up stream. The stones in the bed of any swift stream, may be seen to be arranged in a similar manner, being thus in the most stable position to resist the overturning and

transporting power of the swift current. The former direction of the old current, as shown by the position of these flat stones, does not differ materially from the course of the present river.

2nd. Volcanic Rocks—in large veins or massive eruptions, penetrating, (and overlying?) the stratified rocks in several places.

3rd. Stratified rocks, very recent.—These are about 3,000 feet thick, and at first were placed in one group, the "Toshibets;" but they may be perhaps better divided into two, of which the newer alone, clay rocks and tufas, belong to the Toshibetsu Group; while the less recent underlying shales and sandstones, may be styled the Chingkombe Group. The former reach a thickness of over two thousand feet, and are made up of beds of clay rock, pumice-tufa, soft sandstones and conglomerates. The latter group is over a thousand feet thick, and is composed of beds of harder shales and sandstones. The material of the rocks, of both groups, is almost exclusively volcanic; pumice, either in fragments or as a sand, entering largely into the composition of all. Even the "clay rocks" are fusible before the blowpipe. The lower sand stones of the Chingkombe group alone, are largely made up of debris of the underlying granite; and even these are found to contain pumice in greater or less proportion.

The Toshibetsu group lies in the form of a broad basin, corresponding with the valley of the river. The strata on the eastern side of the basin, dip gently toward the west; but on the western side the beds are highly inclined, dipping to the east. The general direction of the basin is about north and south, plunging to the southward.

The Chingkombe shales underlie these strata on the east side of the valley, having a similar strike and dip, but apparently not quite conformable. They do not

appear on the west within the limit of the survey, though found in full thickness a short distance down the river.

4*th. Granitic rocks,* which occur in a high hill, "Tapkop," on the east side of the valley, underlying the stratified clay-rocks and shales.

GOLD WASHING.

To test practically the richness of the gold-bearing gravel; large measured quantities of the same, were carefully washed by the Japanese method, and the resulting gold weighed on a delicate assay balance.

At the outset, several other plans for making these practical tests suggested themselves. The "pan," the favorite of the gold "prospector" in almost all parts of the world, was tried; but on account of the extreme poverty of the gravel, the results were of little value, as only small quantities could be washed at once, which yielded at times little or no gold, and again, from the same locality, gave very large and flattering results. From selected samples, taken carefully from the bedrock, very promising amounts of gold were sometimes obtained, even in the poorer parts of the field.

It became therefore necessary to devise some plan, by which larger quantities of gravel, taken from the whole thickness of the deposit, could be washed without too much trouble. The "sluice," now used in one form or another, wherever large quantities of gravel are to be washed for gold, could not be employed, on account of the time, labor, and expense, of making the necessary boxes, and putting them in position; and the difficulty of moving the apparatus from place to place, in testing various parts of the field.

The "cradle," said to be used by Chinamen in California, in reworking the old "dump heaps" and "tailings;" was tried by Mr. Blake (on Ponkuroiwa), when he visited

the Toshibetsŭ, but the results do not seem to have been very satisfactory; and I was informed that a larger percentage of gold was obtained by the Japanese method, from the same place, and at the same time.

I therefore decided to test the value of this Japanese method, by comparing it with the work of the "long tom." This apparatus was used in California many years ago, but was abandoned in favor of the "sluice." The long tom is practically a very short sluice, and is therefore not adopted for saving fine gold; but it is much better than the cradle, and it was thought that it might compare very favorably with the Japanese method.

The experiments were made purposely under conditions least favorable to the long tom, the gravel washed being very poor, and the gold fine. The results show a surprising difference in favor of the Japanese method.

In one case, washing with a limited supply of water; one cubic metre of gravel yielded, by the native method, thirty and eight-tenths milligrammes of gold; while the long tom saved but two and six-tenths milligrammes, or about one-twelfth part. In a more favorable locality, washing three cubic metres of gravel in each case, the Japanese method yielded at the rate of sixty-eight milligrammes to the cubic metre; while the long tom gave but eighteen, or only about one quarter.

In favorable localities, and with more practised workmen, undoubtedly much better results might be obtained; but the above experiments showed, that for our work of prospecting in poor gravels, the Japanese method was certainly the best, as well as the most convenient.

Modification of Japanese Method used.—The Japanese method requires but few tools, viz: a "tsuru," or pick, for occasional use in loosening the gravel; two or three special shaped "kua," or hoes, for working the

gravel in the stream or washing ditch ; a "joren" or scoop-shaped bamboo basket for removing the coarse gravel ; two or three "nekoza" or straw mats specially made for collecting the gold ; and an "ita" or board, slightly warped and dish-shaped, used as a "pan" for separating the gold from the concentrated sand.

To these were added a measuring box (or "masu"), made to hold exactly one half cubic metre, and provided with a floor of boards, to ensure accuracy of measuring. Also a couple of shovels were used for filling and emptying this box.

To test the gravel of any desired locality ; a place was selected on a small stream, satisfying, if possible, the following conditions ;

1st.—An exposure of the bedrock below the gravel, at least six inches, or a foot, higher than the level of the stream.

2nd.—The whole thickness of the gravel-bed accessible.

3rd.—A velocity of at least one and a-half or two feet per second: either in the stream itself; or obtainable in a washing ditch, fifteen or twenty feet long, by a dam or other expedient.

4th.—Sufficient water for washing. Sixty to eighty cubic feet per minute, is the most convenient amount, but much less can be used.

A suitable place found ; the bank is cleared of grass, roots, and soil, for a width of about three feet, and from the bedrock to the top of the bank, exposing the whole thickness of the gravel bed.

The measuring box is then placed in position on the bank of the stream, and filled with gravel, only boulders of exceptional size being omitted. In the meantime the gold washers form a washing ditch ; by cleaning the bed of the stream, for a width of two or three feet and a length of fifteen or twenty. When the stream is large it is

divided, only the amount of water requisite for washing being admitted to the ditch. In thus dividing the stream, care must be taken that the stones of the dividing wall are so placed, that all leakage of water is from the main stream into the ditch, and that there is no flow of water outwards; otherwise much of the measured gravel, with its gold, will be lost.

These preparations completed, the gravel is shoveled from the measuring box into the head of the washing ditch, and the box refilled with gravel. At the same time, the gold-washers wash, and throw out, the large stones by hand; and separate the smaller stones from the gravel with the "joren" and "kua." The rapid current washes out all the clay and fine sand, leaving only the fine gravel in the stream. Riffles, built of flat stones, are put across the lower end of the ditch, to arrest the gravel, and to prevent any gold from being carried down stream.

When from four to six boxes of gravel, have been shoveled into the water, forming a bed of fine gravel about a foot thick, the washing on mats begins. Two or three mats, each one foot wide by two feet long, slightly narrower at the lower ends, are placed side by side across the stream, about two feet below the upper end of the gravel. The upper edges of these mats are buried slightly in the gravel, and held in position by the foot of the gold washer, usually one man to each mat, the number of mats being regulated by the width of the stream.

These men now carefully hoe the gravel to the head of the mats, so that it shall be carried over their surface by the force of the current. The heavy gold and iron-sand sink between the thick twisted strands of straw, forming the mat, while the lighter gravel passes down stream. The lower ends of the mats are from time to time lifted, and folded over the upper portion; to transfer the gold to the head of the mat, and to keep the lower part clean.

When all the gravel in front of the mats, has been hoed over their surface ; the men move them about two feet down stream, and begin to work in a similar manner, on the new portion of gravel thus exposed.

Finally, after twenty-five or thirty minutes work, the mats are removed, one by one, from the bottom of the stream ; folded in both directions under water, to transfer the material to the middle ; and then bent in a trough-like form, and "jigged" with a longitudinal motion, under the water, to separate the lighter sand and gravel which still remains. One of the mats is then held in the stream, between the ankles of the gold washer ; folded lengthwise as a trough, through which the water is allowed to flow quietly. A second mat is then seized by the ends, inverted, and folded transversely, the fold being allowed to dip just below the water in the trough of the mat below. The mats are so woven that this folding opens the crevices between the large transverse strands, allowing the gold and iron sand to be washed out by the water. By alternately raising each end of the mat, while depressing the other, the whole surface is successively washed by the stream ; and the various strands of the mat being opened, and loosened, by the folding, the gold and iron sand are very completely transferred to the lower mat. In a similar way, the concentrated material from all the mats is collected on one ; and from this is finally transferred to the shallow wooden washing board. This last transfer is made with great care, in a quiet pool of water ; in which place the final concentration, on the board, is effected.

The separation of the gold from the iron-sand, on this board, requires great care and skill. The board is first floated on the water, and by a few oscillating motions, the material is washed to the centre. Then it is raised from the water, with a number of smart longitudinal jerks ; the

effect of which is to bring the heavier material to the end next the gold-washer, while the lighter sand flows off gradually with the water at the lower end. The board is now brought to the surface of the water, the lower end dipping a little below, and with one or two gentle swings it is again covered with water, while a small quantity of light sand is washed from the lower end. The board is now raised, with the same dextrous shakes as before: the washing being conducted with great care, and but little iron sand being allowed to pass off each time. After five or six minutes, most of the gold will have been brought to the head of the board, the bright yellow grains showing very distinctly in the black sand. The gold may be brought more clearly into view, by allowing a little water to trickle down the inclined board, which washes off the black sand, and leaves the gold exposed.

This first portion of gold, with some of the adjoining iron sand, being removed; the remaining sand is then washed a few times, usually yielding one or two grains in addition.

Finally, the gold, and the small quantity of iron sand taken from the board at the same time; having been dried, are submitted to a careful separation by blowing, the iron sand is carried off, and the gold remains, ready for weighing. In this last separation, a small magnet is sometimes of assistance, in removing large grains of iron sand, too heavy to be blown away.

Samples of gravel were thus washed from the following places in this field.

1.—*Upper Toshibetsŭ.* Gravel was taken from the main terrace on the east side of the valley, very near the northern limit of the survey. The gravel here is only four to six feet thick, and is covered by eight to ten feet of sand and clay. The bedrock, olive-green clay-rock, is

about twenty feet above the level of the small stream, in which the gravel was washed. The gravel is entirely concealed, by the thick bed of sand which covers it; and it was only after considerable trouble, that we succeeded in getting a small sample for washing.

The gravel of this vicinity has been extensively worked in former times, the remains of old ditches being very numerous. At the first place uncovered, the gravel looked as though it might have been disturbed, so that another excavation was made on the opposite side of the valley, where the gravel seemed thicker. At this latter place, after digging through five or six feet of sand we struck the gravel, but for want of time, were not able to reach the bedrock.

One quarter cubic metre, from the whole thickness of the bed of gravel, at the first place; yielded forty-four and two-tenths milligrammes of gold, or at the rate of one hundred and seventy-six and eight-tenths milligrammes to the cubic metre.

One eighth cubic metre, from the upper two feet of the gravel-bed, at the second place; yielded 11.9 milligrammes of gold, or at the rate of 95.2 milligrammes to the cubic metre.

The average yield of the two samples would be about 136 milligrammes to the cubic metre.

An average collection of pebbles, of medium size, taken at random; gave the following percentage of the different rocks; which represents about the composition of the gravel:

Quartz	34
Quartzite and Metamorphic Sandstone ...	19
Granite and Gneiss	29
Mica Schist	4
Talcose Schist	3
Chlorite Schist	11
	100

Mr. Kitagaki, who visited this field, in company with Admiral Enomoto, in the summer of 1872 ; washed a sample of gravel on this same stream, but farther down, from the low river terrace.

2.—*Akabuchi.* Another sample of gravel was taken from the main terrace, on the west side of the upper-valley ; on the bank of this stream, and about four *cho*, ($\frac{1}{4}$ mile) in a straight line, from its mouth. This small valley is lined with a net work of old-ditches and waste heaps, indicating very extensive ancient workings. It was found impossible to secure a suitable place for testing the gravel, where it had not already been washed ; so that we were forced to be content with a place where the bed-rock was reported to be about five feet below the surface of the stream. Three cubic metres of gravel yielded 342.8. milligrammes of gold, or at the rate of 114.3 milligrammes to the cubic metre.

About eleven years ago, Saiyemon, the gold-washer employed by our party, worked in this same place for the government of the Shogun, having five or six men as assistants. The work was continued about two years and a-half ; in which time about two hundred and forty, or two hundred and fifty *momme* of gold* were obtained, from a limited area.

While working actively, the yield was at the rate of two and a half *momme* per month, for each man employed, worth perhaps five and a-half *yen*. Much time, however, was necessarily lost in unprofitable work, cutting ditches, etc.

Admiral Enomoto, when he visited this field, washed a sample of gravel from this same vicinity, but farther down the stream. His sample was not taken from the main terrace, but from a small and local deposit in the ravine ; thus testing gravel derived from the terrace above, but

* 895 to 932 Grammes, or about 30 ounces.

probably somewhat concentrated by the action of the stream.

3. *Kuusube.*—This sample was also taken from the western main terrace: on the north bank of the Kuusube, a large stream which empties into the main river below Akabuchi, and nearly opposite the old office building. The place tested is about ten *cho* ($\frac{3}{4}$ mile) from the mouth of that river, measured in a straight line.

Abundant evidences of the work of the old gold-washers, are to be found on the sides of this stream, the adjoining terrace being in many places covered with a labyrinth of old ditches. A large supply ditch was apparently dug, from the upper part of the Kuusube, near the western limit of the survey, and carried over the main terrace for more than twenty *cho* (about one and a-half miles) to the main river; following along the base of the third terrace in the lower part of its course. Then, by branch ditches, the water was led over the field where wanted; and the gravel of the terrace washed by the regular Japanese method. Work on a similar plan can be traced in the Akabuchi valley; but in this place, apparently from want of water, (as they used only that to be obtained from the small stream itself) the upper part of the valley was not touched.

In two places on the Kuusube, the government washed for gold on a small scale, at the same time as the operations on Akabuchi. The first place is about three *cho* in a straight line from the mouth of that stream, and the other five *cho*. Six men were constantly employed, and the yield per man was about the same as on Akabuchi.

Mr. Enomoto, on the visit already alluded to, washed for gold at a point about seven *cho* ($\frac{1}{2}$ mile) from the mouth of the stream, where the main line of the present survey crosses the Kuusube.

Our sample was taken farther up stream, about ten *cho*

from the mouth, from the northern bank. There are no old gold workings in this vicinity, and the gravel is apparently undisturbed. The bed-rock is about a foot above the level of the stream, and the bed of gravel about seven feet thick.

The composition of the gravel, as shown by an average collection of pebbles, is as follows :

Quartz (impure)	6
Quartzites (showing stratified structure) ...	17
Metamorphic Sandstones	17
Granitic rock	15
Mica Schist	20
Chlorite Schist	14
Talcose Schist	2
Volcanic rock	3
Soft clay shales (bedrock)	6
	100

The position of the flat stones in the gravel, being examined ; they were found to dip to the north, or ten to fifteen degrees west of north. It would seem therefore, that the current that deposited this bed of gravel was more nearly parallel to the main river than to the course of the present Kuusube. This would seem to indicate that the gravel and gold were brought down by the upper Toshibets, but more measurements will be necessary to establish this.

Three cubic metres of gravel from this place yielded 234.6 milligrammes of gold, or at the rate of 78.2 milligrammes to the cubic metre. It will be seen that this result indicates a much poorer gravel than that of Akabuchi ; while the gold-washers, when working for the old Government, obtained here about the same amount as on that stream. If we suppose the gold to be derived from the upper Toshibetsŭ, this is easily accounted for. Our sample,

being taken farther up stream, than the working place of the gold-washers, is consequently farther from the main valley, and would naturally be somewhat poorer.

However, the size of the grains of gold is said to increase as we ascend the Kuusube, so it may be that some of the gold is derived from the upper part of this stream, as well as from the upper valley of the Toshibetsŭ.

4. *Highest Terrace.*—This terrace, 250 to 270 feet above the river, is everywhere covered by a thick bed of yellow sand; making the attempt to reach the gravel, to determine its thickness, and to secure a sample for washing, quite difficult.

Several holes were dug on the slope of the terrace; under the direction of one of the assistants, Mr. Inagaki, and the gold-washer, Saiyemon; with the following results. The first attempt was made on the slope of the terrace, near station (M. 387 t,) on the main line, about forty feet below the level of the plain. The hole was dug through about eight feet of fine yellow sand, and then a stake was driven, about two and a half below the bottom, but without resistance. Another hole was then made near (M. 366 s,) uncovering the bed-rock at a point about eighty-seven feet below the general level of the terrace. This may not be the highest level of the bed-rock, but the true level cannot be far above. A third excavation was made near stake (M. 416 w.) forty-four feet below the level of the terrace, passing through eight (?) feet of sand and clay, and striking gravel at the bottom. The excavation was continued a foot and a half in the gravel, when the work had to be abandoned on account of an accumulation of water in the hole. From this it would appear that the gravel is thirty-five to thirty-seven feet thick, and is covered by fifty to fifty-two feet of yellow sand and clay.

Several samples of the yellow sand, one litre each, were

taken from the first hole dug, and washed, but yielded no gold.

Two like samples of blue gravel, taken from the second excavation, from the bedrock, were also tested by washing; one yielded nothing, while the other gave two small grains of gold, weighing less than one tenth of a milligramme. This would perhaps give an average of about fifty milligrammes, or less, to the cubic metre.

5. *Okajisawa.*—This sample was taken from the main terrace, on the west bank of this stream, about six and a half *cho* from its mouth. The bedrock is here about seven feet above the stream and the excavation was carried eighteen feet above this, the whole height being gravel. The level of the terrace is still ten or fifteen feet higher, a large proportion of which thickness is probably sand. Three cubic metres of this gravel yielded 204 milligrammes of gold, or at the rate of 68 milligrammes to the cubic metre.

The "Long Tom" was tested at this place, saving only about one quarter as much gold, from the same amount of gravel.

6. *Ponkajisawa.* The gravel washed on this stream, in the vicinity of the last mentioned place, was purposely taken from some old heaps of gravel washed by the ancient gold washers, who have left abundant traces of their work in the neighborhood. This waste-heap was tested, with a view to determine how much gold might be obtained by reworking such deposits. The result is not encouraging. One cubic metre of gravel yielded but 30.8 milligrammes of gold, in exceedingly fine grains.

The "Long Tom" was also tested here, as already noted, but with very poor results as compared with the work of the Japanese process, saving but one twelveth as much gold.

7. *Chingkombe.*—One cubic metre of gravel was taken

from the low terrace, in the valley of this large stream, which runs through the south-eastern section of the survey. The sample was taken from a point about five and a-half *cho* above the mouth. The bedrock is here a little above the level of the stream, and the bed of gravel is about five feet thick. One cubic metre of gravel on being washed yielded but 3.4 milligrammes of gold.

An attempt was made to work with the "Long Tom" at this place, but it was not successful, for want of sufficient head of water; although the water was taken one hundred and fifty feet up stream, and led by means of an old ditch, and wooden spouts, to the place of work. The total fall thus obtained was four feet, which was diminished to three feet, by the time it reached the apparatus, at which point we should have had at least three and a-half feet. This shows the great adaptability of the Japanese process to varying conditions; and its superiority, as a means of prospecting, to the Long Tom; for in this one hundred and fifty feet, there were several places, where the Japanese method might have been used to test the gravel of the bank.

8. *Nisheumubetsu.*—This sample was washed to test the gravel of the Pirikabetsu valley. The Pirikabetsu is an important branch stream, entering the main river about opposite Kuusube, and just below the narrower, and richer, portion of the main field that I have called the "upper valley."

The Pirikabetsu has high and broad terraces on either side, corresponding to the terraces of the main valley, but the gravel appears to be almost entirely barren. The sample tested was taken from the main terrace about two thousand feet below the upper limit of the survey; on the west side of the branch stream, Nishemubetsu, and on a small brook emptying into that stream.

The gravel here is five feet thick, and covered by

three feet of soil and clay. The composition of the gravel, determined as usual, is about as follows :

Soft Sandstone	...75
Clay shale	... 2
Quartz	...12
Feldspathic rock	 2
Granitic rock	... 3
Metamorphic Sandstone	... 3
Chlorite Schist (?)	... 3
	100

One cubic metre of this gravel, yielded five very minute grains of gold, weighing less than one tenth of a milligramme.

The following table gives a summary of the results thus obtained, by washing measured quantities of gravel, in the different parts of this field. In measuring, no allowance has been made for the increase of bulk, due to the loosening of the gravel, and to the vacant spaces, necessarily left between the stones, in filling the measuring box.

The gold obtained, was weighed on a delicate assay balance, in grammes and decimals of a gramme ; and the first column contains the results, already given, reduced to a uniform bulk of one cubic metre of gravel. The figures in the other columns, were obtained by simple arithmetical calculations.

In these calculations the following values were employed, derived from various sources ; and verified, where possible, by actual experiment.

One riu-tsubo = 216 cu. shaku = 6.0492 cu. metres.
„ „ = 7.6126 cubic yards.
One momme = 3.7298 grammes.
One momme of pure gold is worth 2.36 yen. (Osaka mint value, 1874.)

The market price of pure gold was also given me at two and a half yen per momme; but the value here used, 2.36 yen, probably better represents the true average value, as it is said to be the standard price paid by the Osaka Mint.

A blowpipe assay, on a small quantity of gold sand from this field, yielded nine hundred and forty parts of pure gold per thousand. One momme of gold sand, at the mint value, would thus be worth two yen and twenty-two and a-half sen, (2.22½ yen) which value was used in calculating the figures given in last columns of the table.

TABLE I, TOSHIBETSU GOLD FIELD, IBURI PROVINCE.

Sample of Gravel Tested.	*Grammes of Gold per Cubic Metre.*	*Momme of Gold per Riu-tsubo.*	*Value of cub. met. in cents.*	*Value of riu-tsubo in sen.*	*Value of one cu. yd in cents.*
1. Upper Toshi.	0.1360	0.2205	8.11	49.06	6 13
2. Akabuchi ...	0.1143	0.1854	6.81	41.25	5,16
3. Kuusube ...	0.0782	0.1268	4.66	28.21	3.53
4. Highest Terrace	0.0500	0 0800	3.00	18.00	2.25
5. Okajisawa ...	0.0680	0.1102	4.06	24.52	3.07
6. Ponkajisawa ...	0.0308	0.0500	1.84	11 12	1.40
7. Chingkombe ...	0.0034	0.0055	0.20	1.22	0.15
8. Nisheumbetsu	0.0001	0.0002	0.01	0.04	0.01
Average*	0.0835	0.1354	5.00	30.12	3.77

The poorest gravel worked in California, by the hydraulic process, yields five to ten cents to the cubic yard; while the average is said to be twenty-five to thirty-five cents. These are the thick gravel deposits, fifty to two hundred and fifty feet thick. Thin placers, like the Toshibetsu field, are usually much richer. In view, however, of the cheapness of labor in Japan, it may be that this field can be worked; indeed it seems quite probable that the upper-valley, averaging seven and a-half

* Average obtained from 1, 2, 3, & 5; giving four times the weight to 3 and 5; as to 1 and 2, these representing the larger area. 1 & 2 together representing but 1/5 of the valley.

cents to the cubic metre, or five and two thirds cents to the cubic yard, will even yield a profit; more especially as water can be had in abundance through the whole season, and at very slight expense for ditches and flumes.

The following sources of extra expense, however, must be considered; as it is quite possible that any one of them may consume all the profits otherwise certain.

1st.—The inefficient labor, which makes two or three men necessary to do the work of one.

2nd.—The thinness of the beds of gravel, entailing the expense of frequent extension or displacement of flumes and ditches.

3rd.—The expense of cutting the dense growth of bamboo, and of disposing of its mass of matted roots.

4th.—The extra expense due to the remains of ancient workings, the nearly barren gravel of which, may have to be rewashed in certain cases, to get at the unworked ground.

TOPOGRAPHICAL SURVEY.

* * * * * * * * * *

The survey of the field was made by the rectangular plan, as adopted at Kaiyanoma and other places. The lines of the survey, run by prismatic compass, and measured by pacing, were checked by more accurate lines run carefully with the transit, with stadia measurements. One such line formed the main line of the survey; while two others, at right angles to this, were run parallel to the paced side lines, and served as a measure of their true direction and length.

* * * * * * * * * *

The errors of this style of survey (by prismatic compass and pacing) are necessarily large—though not so great as might perhaps be expected. The errors tend to

balance each other—so that the final inaccuracy is usually quite small.

I add a table, showing the results of the comparison referred to above, in the case of each of the paced lines. The letters in the first column, refer to the name of the assistant, and the numeral to the number of his line.

TABLE II. ERRORS OF PACED LINES. TOSHIBETSU.

Line.	*Errors in "side" line;*		*Errors in "tie" line:*	
	in direction.	*in length.*	*in direction.*	*in length.*
1 H.	$\frac{3}{4}^\circ$	— 0.6 %	0°	— 0.6 %
2 H.	2°	—17.0 %	$\frac{1}{2}^\circ$	—21.0 %
3 H.	0°	— 5.0 %	$\frac{1}{2}^\circ$	— 2.5 %
1 I.	0°	0.0 %	0°	+ 1.0 %
2 I.	$1\frac{1}{4}^\circ$	+ 2.0 %	$\frac{1}{3}^\circ$	— 2.0 %
3 I.	$\frac{1}{4}^\circ$	0.0 %	0°	0.0 %
4 I.	0°	— 2.0 %	0°	0.0 %
5 I.	$\frac{1}{4}^\circ$	— 2.0 %	0°	— 2.0 %
1 N.	1°	+ 1.5 %	$\frac{1}{4}^\circ$	+ 6.0 %
2 N.	$1\frac{1}{2}^\circ$	+ 5.0 %	$1\frac{1}{6}^\circ$	+ 5.0 %
3 N.	0°	+ 0.7 %	0°	+ 0.7 %
4 N.	0°	— 0.3 %	0°	— 0.5 %
5 N.	1°	— 1.0 %	$\frac{1}{4}^\circ$	— 0.3 %
1 B.	$\frac{1}{2}^\circ$	+ 1.0 %	$\frac{1}{2}^\circ$	+ 1.0 %
2 B.	0°	0.0 %	0°	0.0 %
3 B.	$2\frac{1}{2}^\circ$	0.0 %	0°	0.0 %
4 B.	0°	— 0.4 %	0°	— 1.0 %
5 B.	0°	— 1.8 %	0°	— 1.8 %
1 K.	0°	— 1.0 %	1°	— 1.0 %
2 K.	$\frac{1}{2}^\circ$	+ 4.0 %	0°	+ 4.0 %
3 K.	$1\frac{1}{2}^\circ$	+ 4.0 %	1°	+ 4.0 %
4 K.	$\frac{1}{2}^\circ$	— 2.5 %	0°	+ 1.2 %
5 K.	$\frac{1}{2}^\circ$	— 3.0 %	0°	+ 3.0 %
6 K.	0°	— 4.2 %	0°	+ 4.2 %

* * * * * * * * * *

Area of terraces.—By measurement we find the total area of the bottom of the valley, including all the ground covered by gold bearing gravel, to be about

9,674,000 square metres.

The area of the main terraces, which includes all of the land best adapted for gold washing, (embracing both the 30 feet and the 80 feet terraces) is about

5,305,000 square metres.

The area of the low river terrace and bottom land; which although quite as rich as the main terrace, will be more difficult to wash, the bedrock being often below the level of the stream; is about

200,000 square metres.

The area of the high terrace and terrace slopes; surface covered with gravel, but quite poor or thin, and not available for washing; about,

169,000 square metres.

And finally, the area of the ground already worked, covered with old ditches, most of which lies on the main terraces. This I cannot determine exactly, but roughly estimate it at about

160,000 square metres.

These areas do not include the upper part of the Chingkombe valley, which several tests, on small quantities of gravel, show to be barren; nor the Pirikabetsu valley already shown to be very poor.

From this we see that there is available for gold washing, after deducting the ground already washed, about

5,145,000 square metres

or, taking the average thickness of gravel on these terraces at three metres,

15,435,000 cubic metres.

This would be, however, too poor to be washed with profit, yielding but five cents to the cubic metre or only three and three-quarters cents to the cubic yard.

If the upper valley alone were washed, we should have available about

800,000 square metres or,
2,400,000 cubic metres of gravel.

yielding seven and a half cents per cubic metre : giving a gross yield of gold worth.

180,000 *yen.*

To extract this amount of gold would cost ; say, 100,000 *yen* and leave a profit of perhaps 80,000 *yen* to be obtained in five to ten years work ; depending on the number of men employed.

These estimates of cost and profit, are of course only very rough guesses ; but in view of the numerous conditions which enter into the problem, which can only be determined by actual trial—such for instance, as the cost, per cubic metre, of disposing of the bamboo—it will be hardly possible to estimate more exactly.

Volume of water in the various streams.—A few rough measurements were made to determine the volume of the different streams in the valley ; with a view to ascertain how much water may be made available for gold washing. The results are given in the following table, expressed in cubic feet of water delivered, by each stream, per minute.

TABLE III, VOLUME OF WATER, TOSHIBETSU.

Toshibetsu—above Akabuchi (estimated)....	7,500 cu. ft.
Akabuchi.....	150
Pirikabetsu (estimated).....	4,200
Kunsube	2,850
Kuroiwa, and small streams (estd.)	300
Toshibetsu—below Kuroiwa.....	15,000 cu. ft.
Okajisawa, and small streams (estd.)	600
Chingkombe.....	1,800
Toshibetsu below Chingkombe (about).....	17,400 cu. ft.

Of this amount, the water of the upper Toshibetsu, (certainly under-estimated) and of the Kuusube, can easily be diverted into ditches, at such a height as to command all the gravel of the field. We should thus have available, something more than ten thousand cubic feet of water per minute, or enough to supply ten or twelve large hydraulic workings, and to wash seven and a-half to nine thousand cubic metres of gravel per day.

Timber.—The whole valley is wooded, though the growth is nowhere dense. Some of the trees are quite large. The proportion of good building timber is small, neither pine nor cedar occurring in any quantity, though said to be obtainable at no great distance. Nearly all the trees are hard wooded, and best adapted for firewood.

Stone, Building material.—The only stone suitable for building found in this valley is granite ; unless possibly some of the lower sandstones of the Chingkombe group, made up of the debris of granite, may be available, these however stain quite badly on exposure. The granite, where exposed in place, is almost always soft and crumbling, but an abundant supply of building stones may be secured from the large boulders in the bed of the streams.

A small quantity of lime could be made from the concretions of limestone, which occur in the red shales of the Chingkombe group. These concretions occur as loose boulders in several places, having been washed out of the shales by the action of the river.

KUDO GOLD FIELD.

KUDO GOLD FIELD.

On leaving the Toshibetsŭ Gold Field I was instructed to proceed down the Toshi river to the west coast; and along that coast to Kudo and Esashi, near which places gold was reported to occur.

On the voyage down the river, the Toshibetsu series of clay rocks and the underlying shales and sandstones were traced for a long distance both to the south and west. These strata were usually dipping westward, and the total thickness seems to be nearly five thousand feet. In the lower valley all rocks are concealed by a thick bed of river alluvium, and near the mouth only a small exposure was seen; clay rock underlaid by a hard sandstone, and covered by volcanic rock.

The coast, between the mouth of the river and Kudo, presents some exceedingly fine exposures of volcanic and metamorphic rocks, to be more fully described in another place.

About one ri (2½ miles) south-east of the village of Kudo, two large streams, the Mōshibetsŭ and the Usubetsŭ, empty into the Japan Sea about three or four *cho* (¼ mile) apart. The valley of the more northern and smaller stream, the Mōshibetsŭ, runs nearly north and south, and is quite narrow, only one or two *cho* wide at the bottom; while the valley of the larger stream, the Usubetsŭ,

runs at first north-eastward from the coast, and then about east and west. This valley is much wider, varying from one *cho* to four and a-half.

The gravel, said to be gold-bearing, occurs only at the bottom of these small valleys, the high marine terrace above showing only yellow alluvium, sand and clay. There are no terraces proper within these valleys, only a flood plain, five to eight feet above the river.

Survey.—A hasty survey of these streams was made by the assistants, with prismatic compasses, the distances being measured roughly by pacing, and the contours of the hills merely sketched. From the map, resulting from this survey, it seems that the valley of the Moshibetsu contains about

288,000 square metres

of gold-bearing gravel, while the Usubetsu valley, so far as surveyed, contains

1,240,000 square metres.

Taking the average thickness of the gravel at one and a-half metres, this would give respectively :

Moshibetsu...	...	432,000 cubic metres.
Usubetsu ...	...	1,860,000 cubic metres.
Total	...	2,292,000

In both valleys the bedrock is concealed, being somewhat below the present bed of the stream ; but from several trials I am convinced that the gravel is at least as thick as given above—perhaps even thicker.

Gold Washing.—The gravel of each valley was carefully tested by washing large samples from very favorable situations. Two cubic metres were washed in each case, the method employed being the same as that used on the Toshibetsu, and described in the account of that field.

The results obtained are given in the following table:

TABLE IV. KUDO GOLD FIELD. SHIRIBESHI PROVINCE.

Sample of Gold washed.	*Grammes of Gold per Cubic Metre.*	*Momme of Gold per Riu-tsubo.*	*Value of 1 cu. m. in cents.*	*Value of Riu-tsubo in sen.*	*Value of 1 cu. yd. in cents.*
1. Moshibetsu ...	0.0070	0.0114	0.42	2.50	0.30
2. Usubetsu ...	0 0011	0 0018	0 07	0.40	0.05

1. *Moshibetsu.*—Two cubic metres of gravel washed. Bank five feet high; upper two feet soil; excavation carried two feet below water; total thickness of gravel tested, therefore, equals five feet. Gravel coarse, containing some large stones. Gold quite fine, some grains almost microscopic.

2. *Usubetsu.*—Two cubic metres of gravel washed. Terrace four feet above water level, upper two feet fine brown sandy soil. Three feet of gravel washed, the lower foot below the level of the stream. Gold very fine; grains smaller than the above.

These results agree very well with those obtained by the gold-washer, Saiyemon, the year before; when he tested the gravel of other places in these same valleys.

The small amount of gold obtained, is enough to prove that gold exists in the gravel of these rivers, but certainly in too minute quantity ever to be of any value.

The bedrock varies in different parts of the field, volcanic rock predominating. Near the sea, on the Usubetsu, we have soft clay rocks and tufas; and in the Moshibetsu valley, older shales and sandstones appear underlying these rocks, and associated with volcanic dykes and overflows. The geological relations of the rocks of these valleys are very interesting, and will be described more fully in another place.

The gravel is wholly made up of metamorphic and volcanic rocks, and contains little or no quartz. An average collection of the pebbles yielded:

Light green tufa rock (hard) ...	... 47
Sandstones	... 12
Slate (?)	... 5
Mica Schist	... 1
Granitic rock (Syenite or Porphyry)	... 12
Volcanic rock...	... 23
Total	...100

The source of the minute proportion of gold in this gravel, is probably within the limits of the survey, as gold is not found in the upper parts of these valleys. It is possible that it may come from a slaty rock, which is found in places penetrated by minute seams of quartz.

Coal.—While examining these gold deposits, my attention was called to some thin beds of coal, which occur in the shales at the upper end of the valley of the Mōshibetsŭ.

The section of the rocks exposed with the coal is as follows.

Laminated dark greenish brown shale ...	4.4 ft.
Poor coal, with much pyrite, ...	0.3 to 0.4 ft.
Blue clay rock, ...	0.7 to 0.5 ft.
Coal, very bony, ...	0.3
Argillaceous sandstone, ...	0.7 to 0.3
Fire clay, gray, ...	4.0
Coal, soft, ...	0.3
Sandstone, brown, argillaceous,... ...	0.6 +

The clay parting between the upper beds disappears in one place, the two seams uniting to a bed 1.4 ft. thick.

The coal is exposed on both sides of a small saddle or anticlinal, the elevation being apparently due to a dyke of volcanic rock, which forms the dividing ridge, and breaks through the coal rocks. The strike of this dyke is the same as that of the shales, fifty degrees east of north. The coal rocks dip thirty degrees south-east, and forty

degrees to the north-west, away from the volcanic rock on each side.

This deposit of coal is so thin and bad, as to be quite worthless; but the fact that the strike of the rocks is the same as that of the coal rocks of the Kayanoma field, is not without interest.

Copper.—In a hard, fine grained, light green tufa rock, near the eastern limit of the survey, in the small valley of the stream Yunosawa; there is a thin lenticular (?) vein of quartz holding blende, copper pyrite and erubescite. This vein has been explored by a small drift for about nineteen feet. It varies in thickness from 0.5 to 0.2 ft., but is mainly quartz and blende, holding but a small quantity of the copper minerals. Near the end of the tunnel, the vein pinches out to nothing, at the bottom, though continuing about the same thickness at the top.

Eight feet below this tunnel, and near the level of the stream, another smaller drift was begun on the same vein; evidently intended as a drainage level and air-way; but was continued but two or three feet.

This vein of copper ore is nowhere rich enough to pay for working, and it seems doubtful if it continues for any great distance beyond the end of the present tunnels. In view of the fact that it is apparently the only deposit of the kind in the vicinity, it will be hardly advisable to push the exploration farther.

ESASHI GOLD FIELD.

ESASHI GOLD FIELD.

While in Kudo we learned that gold had been found in several of the valleys near Esashi. Proceeding to that place we noticed that the gravel of all the streams, from a point about four *ri* north of that town, was composed of sandstones and metamorphic rock, holding a large percentage of quartz. The gravel of the Otobe river, three *ri* (7½ miles) before Esashi, was tested in one or two places in passing; but only a minute proportion of gold was obtained, enough however to show that the field contained gold, though unfortunately not in paying quantities.

A similar gravel, apparently auriferous, was observed in places on the top of the marine terrace, usually covered with a thick bed of sand and clay.

Arrived at Esashi we learned that the valley of the Jimikishi, a stream emptying into the sea within the limits of the town, was supposed to be the richest gold field in the vicinity. This supposition afterwards proved to be quite correct, as will appear on inspection of the results obtained.

During the few days we remained in Esashi, the assistants spent the time in surveying this Jimikishi valley, while the gold-washers were employed in washing for gold on that stream, and in other valleys of the district.

Gold Washing.—Samples of gravel were washed at the following places.

1. *Otobe river,* a large stream three *ri* (7½ miles) north of Esashi, already referred to. The gravel of this stream was tested at a point ten *cho* (¾ mile) above the mouth. The gravel washed was not measured, but estimated at about one quarter cubic metre. The bedrock was not reached, as the river is now running above the level of its old bed; not only higher than the bedrock, but in most places even above the bed of gravel. Thickness of gravel unknown, upper one and a half feet only washed. Yield one half milligramme of gold, or about two milligrammes per cubic metre.

2. *Jimikishi river.*—At station (M. 878 r) twenty *cho* (1½ miles) from mouth of the river. Gravel measured in the bank, about one cubic metre. Bedrock, decomposed mica-schist, three feet above level of stream. Bed of gravel, eight feet thick, covered by one and a-half to two feet of brown sand. Sample taken from lower five feet. Gravel contains a good proportion of large stones, one cubic foot and more in size.

An average collection of pebbles yielded :

Quartz	12
Quartzite	13
Gneiss	6
Mica Schist	15
Talcose Schist	7
Sandstone	34
Slaty shale	10
Volcanic rock (pumice)	3
	100

Gold comparatively course, in flat grains. One cubic metre yielded 29.0 milligrammes.

3. *Jimikishi river.*—Near station (N. 552 v.) twenty-four and a half cho (1¾ mile) from mouth. Two cubic

metres of gravel washed. Bed of gravel three and eight-tenths feet thick, and covered by two feet of soil. Bed-rock six and a half feet above the stream. The whole thickness of the gravel was washed: yield 8.8 milligrammes or about 4.4 milligrammes to the cubic metre.

4. *Gokatte kawa.*—A small stream at the south end of the town. Sample taken at a point about ten *cho* ($\frac{3}{4}$) mile) from the mouth of the stream. Bank about five feet high of which the upper two feet is soil. Bedrock not reached (?) One half cubic metre of gravel washed, yielding but one minute grain of gold, weighing abont one-tenth milligramme; showing that the land is much more valuable, as utilized, for market gardens than it ever could be, as a gold field.

5. *Todo river.*—One and a half *ri* from Esashi to the south. Bed of gravel about four feet thick, of which one foot is below water. Gravel covered by one and three tenths feet of soil. Bedrock reached, one foot below the water; and one cubic metre of gravel taken, from the whole thickness of the bed. The resulting gold very fine, weighing one and two-tenths milligrammes, Valley narrow, about five hundred feet wide, and cultivated. Stream large; fifteen to twenty feet wide at this point.

6. *Mena river.*—A large stream two *ri* (five miles) south of Esashi. Gravel tested at a point one and a half *ri* up stream. Valley here quite narrow, but the river, even as far up as this, flows some distance above its original bed. Bedrock not found. One cubic metre of gravel was taken from a bank about five feet high, and the excavation was continued below water level but without reaching bed-rock. The gold obtained was exceedingly fine. One cubic metre of gravel yielded but eight-tenths milligrammes of gold. An average specimen of the gravel yielded.

Quartz	17
Quartzite	7
Talcose schist	3
Mica schist	19
Gneiss	3
Slate, &c.	7
Red schist (?)	4
Sandstone	40
	100

The rocks of this part of the valley are mica schists, quartzites, &c. Near the sea these are overlaid by modern tufas and clay rocks, as in the lower Jimikishi valley.

The following table gives a resumé of the results obtained:

TABLE V. ESASHI GOLD FIELD. OSHIMA P.

	Sample of Gravel washed.	*Grammes of gold per cu. metre.*	*Momme of gold per Riu-tsubo*	*Value of 1 cu. m. in cents.*	*Value of 1 Riu-tsubo in sen.*	*Value of 1 cu. yd. in cents.*
1	Otobe	0.0020	0.0032	0.12	0.71	0.09
2	Jimikishi	0.0290	0.0473	0.73	10.46	1.31
3	Jimikishi	0.0044	0.0071	0.26	1 58	0.20
4	Gokatte	0.0002	0.0003	0.01	0.07	0.01
5	Todo	0.0012	0.0019	0.07	0.42	0.05
6	Mena	0.0008	0.0013	0 05	0.29	0.04

It will be seen that the gravel of this gold field proves to be exceedingly poor, far too poor to be worked; not only in the unfavorable cases where it was found impossible to reach the bedrock, but even under the most advantageous conditions, as on the Jimikishi. Even were this not the case, it would be exceedingly difficult to work these deposits. The larger rivers are all extremely sluggish, often losing themselves in swamps, and even when followed nearly to their source, the

fall is still quite gentle. By the Japanese process, it would be impossible to carry on properly, any large washing operations in the lower parts of these valleys ; as the bedrock is in many places below the sea level, or so little above as not to give sufficient fall to the ditches. Even in the smaller valleys, or in the upper part of the large streams, it would be difficult to keep the bedrock in sight, as these sluggish streams would rapidly become silted up by washed gravel, raising the level of the river above. To work these deposits by sluicing, would require expensive elevated flumes to give the necessary fall, and the gravel would have to be raised to the level of these sluices by mechanical power, entailing an expense only warranted by very rich ground.

The gravel, already mentioned, on the terrace between the rivers, might be worked without difficulty, but it is probably even poorer than that of the valleys ; as this latter, originally of the same richness, has been undoubtedly much concentrated by the action of the streams.

Topographical Survey.—The survey of the Jimikishi valley was finished at about the same time as the gold washing. The course of the river was run by prismatic compass, and the distances approximately measured by pacing, as in the Kudo survey. The height and slope of the hillsides were determined by lines across the valley, the levels being taken by repeated barometric readings. Sights on the hills, taken with the compass, aided the plotting of the topography, which was copied from sketches taken in the field. The result is a rather more accurate map than that of the Kudo field, but as the paced distances are not checked in any way, there may be considerable inaccuracy in this regard.

From this map it would appear that the main valley is $32\frac{1}{2}$ *cho* long ($2\frac{1}{4}$ miles) and from forty *ken* to three and

a half *cho* (240 feet to $\frac{1}{4}$ mile) in width. It contains 578,000 square metres of bottom land, covered with an average of 1.8 metres of gravel.

While at Esashi we were informed of gold fields, then being worked, in the vicinity of Matsumai; said to be quite rich. Owing to the lateness of the season, and to the fact that the lead mines at Yurap were still to be surveyed, it was decided to put off the examination of the Matsumai fields, and to proceed at once to Yurap.

The survey of the Yurap mines was only partially finished, when we were ordered to Hakodate, and it has not been completed since. The results of the examination of the old mines at that place, and of the study of the geological relations of the rocks, will be given elsewhere.

MATSUMAI GOLD FIELDS.

MATSUMAI GOLD FIELDS.

PROVINCE OF OSHIMA.

On taking the field last year, I was ordered to proceed to Matsumai, and to test the richness of the gold fields in that vicinity; visiting at the same time any deposits of useful minerals to which my attention should be called by the Japanese officials of the province.

In the immediate vicinity of Matsumai, there are a number of gold-fields of small extent; from which, it is said, large amounts of gold have been taken by gold-washers from the south, some six or seven hundred years ago. These fields were visited, but found to be entirely exhausted.

The road from Hakodate leads along the sea shore to Shiriuchi, thence up the valley of the Musa river, and across the Shiriuchidake to the coast, and so to Matsumai. In passing through the Musa Valley, I was struck by the appearance of the gravel in the streams, and covering the high terraces in either side; and was not surprised to learn, on inquiry, that party of gold-washers from Matsumai, had been working here the previous season.

On reaching the town of Matsumai, or "Fukuyama", we found the gold-washers to whom we had been directed from Hakodate, and learned that this Musa Valley was the gold field referred to by our informants. Accordingly

after spending a few days at Fukuyama, we returned to the Musa, making our head quarters at Ichinowatari.

Lead Mines.—My attention was called to some veins of lead ore at Akagami, about one *ri* from the coast, on a small stream about two and a half *ri* north-west of Fukuyama. At this place we found several old exploring tunnels, which have been abandoned for many years. The lead ore occurs in small veins associated with blende, pyrite, &c. The fissures are in some places as much as a foot in width but the seams of ore are rarely more than one or two *sun* (0.1 to 0.2 ft.) thick. The predominating mineral is zinc blende; galena, the ore of lead, occurring in small proportion, and pyrite in still smaller amount.

A sample of the washed lead ore, (galena) was tested for silver, but found to contain but a trace of that metal.

These veins are neither large enough, nor sufficiently numerous, to pay for working. Their chief interest lies in their resemblance, on a small scale, to the lead bearing veins at Yurap; and to similar deposits now worked at Daira, in Akita ken, on the main island.

The veins have a nearly east and west direction (N. 80° W., dipping 70° to 80° S.) traverse a dark blue quartzite, and are associated with a white quartzose porphyry (?); in all these points, and in the character of the ore, resembling the veins of Yurap and Daira.

Silver ore, so-called,—While in Fukuyama a specimen of lead, said to have been derived from the smelting of a newly discovered silver ore, was brought to my hotel. On assaying the lead I found it to contain about six and a quarter per cent of silver! and accordingly I visited the place and secured samples of the ore. This discovery was made near Kurodaki, on Kazamisan-no-sawa, between Fukuyama, and Fukushima, some little distance off the road. On cross-questioning the discoverer, I found

that he had been directed by the "gods" in a vision, to dig in a certain place, on the side of the hill near his house; where he was to find a valuable mine.

He accordingly made a huge excavation in the place indicated; and taking out a few cubic feet of ore (?), pulverized, and washed it, and smelted it with a little ead. The product of th is fusion was the button of lead brought to me at Fukuyama. Thinking that the lead added might have originally contained silver, I secured a small sample for assay.

Subsequently on assaying the ore, apparently a partially decomposed slaty rock, I found that it contained no silver whatever, and on testing the lead added, I found only a small fraction of one per cent of the precious metal.

Under the circumstances, it is difficult to account for the silver in the specimen of lead brought to me, unless we suppose that the kind "gods," careful for their own reputation, caused a small piece of silver, perhaps as large as a ten cent piece, to drop from the man's sleeve while he was stirring the fire!

MUSA GOLD FIELD.

MUSA GOLD FIELD.

PROVINCE OF OSHIMA.

The history of this gold-field is exceedingly interesting. Mr. Nakano, my interpreter, while on the spot took the pains to collect the following traditions from the people of the valley.

It seems that in the second year of Genkiu, about six hundred and seventy years ago; a small boat, from the province of Chikuzen, was blown to sea, carrying off two sailors and their cook. This boat finally landed on the shore of Yesso, near Shiriuchi, where they waited for fair winds to return home. The cook, looking for water, found a bright lustrous stone at the foot of a waterfall, which excited his curiosity, and which he concealed from his companions, and took with him to his home in Chikuzen. At a convenient opportunity he gave this stone, which appears to have been a grain, or small nugget, of gold, to his master, a small daimio named Araki Daikaku. The daimio sent the nugget to the Shôgun, Yoriiye (the next in line to Yoritomo) who was then living at Kamakura.

This discovery of gold proved to be of sufficient interest, to induce the Shôgun to order Araki Daikaku to proceed to Yesso, taking with him the cook as a guide, to determine whether gold existed there in valuable quantity.

The Shôgun also rewarded the discoverer with a present of a thousand koku of rice, to which the daimio added a hundred and fifty koku from his own income, at the same time allowing him to assume the name of Araki Geki.

Araki Daikaku now engaged a force of eight hundred laborers, coolies and gold-washers; with a sufficient body of military men for their defence, and a "Shugenja," or priest, to attend to their spiritual wants. The total number of men who sailed for Yesso was over a thousand.

The party left their native province on the twentieth day of the sixth month of the same year, (the chronology is very exact!) and landed at Yukoshi (near Shiriuchi?) on the twenty-third day of the month following.

On landing, they built a castle on Kenashidake, and began to wash for gold.

They stayed thirteen years, washing first on a small stream near Shiriuchi, and afterward on the Musa river and its branches, obtaining a large amount of gold. They also built another castle for the quondam cook, Araki Geki, in a favorable spot at the foot of Kenashidake. The site of this castle is called Geki-no-yama to this day.

At this time the Ainos were a very savage and warlike race, and gave the gold-washers no little trouble. Finally the ill-feeling culminated; and after a desperate battle, the Ainos became masters of the field; killing the whole party of Japanese; with the exception of the priest, who, with his family, was concealed by a friendly Aino. This solitary survivor died a short time after, but at the good old age of one hundred and five years.

The Ainos, emboldened by the victory, crossed the straits in large force, and made vigorous war on the Japanese. They were however finally defeated and destroyed by the Shogun's troops.

Since the massacre of these old gold washers, the field

has been abandoned. The summer before our visit, the party of gold-washers from Fukuyama spent about sixty days in the valley, and washed out about eight *momme* of gold; (30 grammes, or about an ounce) which brought the field to the notice of the government.

On arriving at Ichinowatari, a few days were spent in making a preliminary survey of the river, and in washing for gold. Some difficulty was experienced in finding suitable places for testing the gravel, the Messrs. Araki having washed all that was easily accessible from the streams. The third day's prospecting developed gravel richer than any of the Toshibetsu, near the lower end of the field; and it was accordingly decided to undertake a more careful survey of the valley.

Gold Washing.—Samples of gravel were washed at the following places. In each case, unless otherwise stated, the sample represents the whole thickness of the bed of gravel, from the bedrock to the top. The barren layer of yellow sand or clay soil, which invariably covers the deposit, was not washed with the gravel; as it contains little or no gold, and would cause but little inconvenience, and a very slight additional expense, in washing the gravel on a large scale. Where the thickness is considerable it must of course be taken into account.

The gold-washing was done in the same manner as the year before, by a modification of the Japanese process; this method having proved so well adapted to the work. The only change this season, was to increase the amounts of gravel washed in each place; the maximum sample before being three cubic metres, this year four to eight cubic metres were treated. This involved two or three days work at each place, but the greater accuracy attained, quite compensated for the additional time required.

1. *Upper Musa.*—Among the first places visited was the upper part of the Musa valley beyond the region of the terraces. The river here runs between high hills of metamorphic rock, and the valley is quite narrow at the bottom. But little gravel is deposited here, and no suitable testing place could be found. One cubic metre of sand, from the river bank, was washed and yielded 1.7 milligrammes of fine gold, with one grain of medium size. Not a large yield, but as much as we should expect to find in such fine gravel, and interesting as an evidence of the direction from which gold is brought into the valley.

2. *Sumikawa.*—For the same purpose a sample was washed in the upper part of the Sumikawa valley, beyond the limits of the survey. The Sumikawa is an important branch stream, entering the main valley about a mile above our head quarters at Ichinowatari, and near the upper limit of the high terraces. This valley is somewhat wider than the upper valley of the Musa, and has a low river terrace bordering its banks. At the point tested the gravel was four and a half feet thick, and covered with about two and a half feet of common soil. The bed-rock is at the level of the stream. One and a half cubic metres of gravel, yielded eight and three tenths milligrammes of gold, or five and a half milligrammes per cubic metre. Gold of average fineness, containing some large grains.

3. *and* 4. *Sanjiurono.*—This terrace, 75 to 100 feet above the level of the stream, extends from Ichinowatari to the head of the main valley, on the south side of the river. About half of its area has been worked by the men from Chikuzen, and it was with some difficulty that we found small patches of untouched gravel, amidst the labyrinth of old workings.

The first place tested, at station (M. 1360 p,) is on the bank of the main river, a short distance below, and op-

posite, the mouth of Sumikawa. The bedrock here is about ninety feet above the river, and the gravel is about six feet thick, covered by yellow sandy soil and clay-rock pebbles three and eight-tenths feet thick. Two and a half cubic metres of this gravel, yielded fifty-five milligrammes of gold, or twenty-two milligrammes to the cubic metre. The gold is in rather fine grains.

The second place on this terrace (M. 1369 q.) is about four *cho* farther down stream, or about nine *cho* above Ichinowatari, and also on the top of the bluff bordering the river. The bedrock is sixty-three feet above the river, and the gravel about ten and eight-tenths feet thick, including the three or four feet of sand at the top. The general level of the terrace is about three feet higher. Seven cubic metres of gravel from this place yielded two hundred and thirty three milligrammes of gold, or about thirty two milligrammes per cubic metre. Gold very coarse, in flat grains, some weighing as much as thirty or forty milligrammes.

The results obtained at the two places on this terrace illustrate the value of washing large quantities of gravel. The gold-washers being sent out to "prospect" visited both places. From the first, they obtained very little gold, while from the second place, they secured one hundred and seventy one milligrammes, from but a small quantity of gravel. Yet the two places are about equally rich, as is shown by the more accurate results given above.

5. *Tsunaharino.*—Opposite Ichinowatari, on the north side of the river, is a large terrace called Tsunaharino. ("The rope stretching plain") extending to Gobansaka at the mouth of Tsunaharino-river. The bedrock here is about sixty-five feet above the level of the river. The gravel is only five feet thick, and is covered by four feet of sandy clay and one and a half feet of black soil. Total thickness, ten and a half feet. No stream large enough

for gold-washing crosses this terrace, so that it was difficult to test any of the gravel. A small quantity, one half cubic metre, was lowered to the main river and washed there, but proved exceedingly poor, yielding but nine-tenths milligramme of gold, or one and eight-tenths to the cubic metre. It seems hardly likely that it can be so very poor, but the old gold-workers have avoided this field, for only a few evidences of their work exist, and these apparently only prospecting holes.

An intermediate terrace, between this and the river, and fifteen to eighteen feet lower, may have been richer, for it is completely covered by old ditches and waste-heaps.

6. *Tsunaharinosawa.*—This sample of gravel was taken from the low river terrace, near the mouth of this stream, opposite the village of Gobansaka and near the main road from Hakodate.

This place was chosen by the assistant in charge of the gold washing that day, who probably misunderstood my instructions, as I expected him to take the gravel from the main terrace above. The gravel here has been derived from the main terrace, and concentrated by the action of the stream. The area of the deposit is small, and the thickness irregular. Where the sample was taken, the gravel is three and a half feet thick, and rapidly thins out to nothing, as the bedrock rises. The sample is therefore not a representative one, and of no use in determining the value of the field. Four cubic metres yielded 166.6 milligrammes of gold, or 41.7 milligrammes to the cubic metre. The gold is in coarse grains.

7. *Gobansaka.*—Above the village of Gobansaka, and above the main terrace, is a table land forming the boundary of the valley, and extending to Yunoshiri, the lower limit of the survey. The height varies, from two hundred and fifty to two hundred and seventy-five feet above

the river at Gobansaka—to one hundred and fifty feet above, at Yunoshiri. This high terrace (?) is in most places covered with gravel. A sample of two cubic metres, was washed on a small stream above Gobansaka, and yielded only seven and a half milligrammes of gold or three and three quarters milligrammes to the cubic metre. Grains of gold of average size.

8. *Masarisawa.*—A stream emptying into the main river, about opposite Gobansaka. The sample of gravel washed on this stream was taken from the main terrace some distance up stream, beyond the boundary of the old workings, and near the base of the foot hills. The gravel here is quite thick, twelve to fifteen feet, but proves to be quite poor. Seven cubic metres yielded but nine and seven-tenths milligrammes of gold, or one and four-tenths milligrammes to the cubic metre.

9. *Shikubeno.*—This terrace extends on the south side of the valley, from about opposite Gobansaka to Shikubeno-no-sawa. The bed rock is about fifty feet above the river, and the gravel is from ten to twelve feet thick, including three or four feet of yellow sand and soil. The sample of gravel was taken from the bank of a small stream, near the lower end of the field, where the Fukuyama gold-washers had been working the previous season, and from which place the greater part of their gold was obtained. Three cubic metres of gravel being washed, we obtained fifty-one and one-tenth milligrammes of gold, or at the rate of seventeen milligrammes per cubic metre. The gold was somewhat coarser than the average.

10. *Shikubeno-no-sawa.*—Two cubic metres of gravel, taken from a point in the upper part of this valley, though very carefully washed, yielded only a single small grain of gold weighing four-tenths milligramme, or at the rate of two-tenths milligramme per cubic metre.

11 and 12.—*Yunoshiri Terrace.* In the lower section of the survey, where the river turns and flows northward, the main terrace is on the west side of the valley. The middle and east side of the valley are occupied by a large flood plain, quite low and in many places swampy. There is also in two places on the east side of the valley, between Shikubeno and Yunoshiri, a small terrace about forty feet above the river level.

The Yunoshiri terrace is quite narrow, in many places only about one cho wide. The bedrock lies from 80 to 85 feet above the river and the gravel is ten to thirteen feet thick, covered by six to ten feet of soil.

The first place tested, at station (M. 1376 s,) is on a small stream about nineteen *cho* above Yunoshiri. The gravel here is thirteen feet thick, covered by ten feet of soil. Eight cubic metres of gravel yielded about eighty one milligrammes of gold, or ten and one tenth milligrammes to the cubic metre. The grains of gold here are somewhat finer than the average.

The second place is on a small stream running across the terrace, about twelve *cho* farther down the valley, or about seven *cho* above Yunoshiri. The gravel here is somewhat thinner than that above, the whole thickness of the terrace being but sixteen feet. The level of the bedrock is about the same. Four cubic metres of gravel, yielded 37.7 milligrammes of gold, or 9.4 milligrammes per cubic metre. Grains of gold fine.

13.—*Yunoshiri.* The richest place discovered within the limits of the survey, is at the end of the Yunoshiri terrace, just above the village. Probably an eddy was formed here by the meeting of the stream Yunoshiri with the main river, and so the gold was concentrated in this spot. The bed of gravel is quite thin (5 to 6 feet?) the sample having been taken from a little point of terrace where the upper portion of the deposit had been washed

away. Seven cubic metres of gravel from this place yielded one gramme twenty-six and a half milligrammes of gold or one hundred and forty-six and six-tenth milligrammes to the cubic metre. The last day's washing, two and a half cubic metres, yielded over six hundred milligrammes of gold, or at the rate of about two hundred and forty milligrammes to the cubic metre. One riū-tsubo would, at this rate, be worth eighty-eight sen, or about eleven cents to the cubic yard.

It is perhaps unfortunate that this rich deposit was found at this time (during the preliminary survey) for could I have known that it was the only one of the kind, and known also what the average value of the field would prove to be, I should certainly not have undertaken so large and complete a survey as I have now the honor to report.

14. *Minagoya.*—In order to determine the value of the field below Yunoshiri, beyond the limit of the survey, a sample of gravel was washed at this place, about a ri ($2\frac{1}{2}$-miles) farther down stream.

Below Yunoshiri the low river plain widens, and the main terrace becomes very small, only appearing here and there. The river terrace is largely composed of the debris of the soft clay rocks and shales, with thick beds of silt. The gravel of the upper terrace looks somewhat better.

The sample was taken from this upper terrace on the west side of the valley, near the village Hagisawa, and from the bank of the stream, Minagoya. Seven cubic metres of gravel yielded fifty-nine and one tenth milligrammes of gold, or at the rate of eight and four-tenths milligrammes to the cubic metre.

The following table give a summary of the results obtained at the different localities;

TABLE VI. MUSA GOLD FIELD. OSHIMA PROVINCE.

Sample of Gravel Locality.	*Grammes of Gold per Cu. Mtr.*	*Momme of Gold per Riu-tsubo.*	*Value of one cu. m. in cents.*	*Value of 1 Riu-tsubo in sen.*	*Value of 1 cu. yd. in cents.*
1. Upper Musa ... M 1329 f	0.0017	0.0027	0.10	0 60	0.08
2. Sumikawa O 231	0.0055	0.0089	0.32	1.89	0.25
3. Sanjiurono ... M 1369 q	0.0319	0 0517	1 89	11.50	1.44
4. Sanjiurono ... M 1360 p	0.0220	0.0357	1.31	7.93	1.00
5. Tsunaharino ...	0.0018	0.0029	0.11	0.65	0.08
6. Tsunaharinosawa O 153 r	0.0417	0 0676	2.49	15.04	1.88
7. Gobansaka ... M 1343 k	0.0038	0.0062	0.23	1.38	0.17
8. Masarisawa ... M 1347 o	0.0014	0.0023	0.08	0.51	0.06
9. Shikubeno ... M 1319 c	0.0170	0.0275	1.00	6.01	0.75
10. Shikubeno-nosawa O 222	0.0001	0.0003	0.01	0.07	0.01
11. Yunoshiri Terrace M 1376 s	0.0101	0 0164	0.60	3.65	0 46
12. Yunoshiri Terrace M 1377 t	0.0094	0.0153	0.56	3.40	0.43
13. Yunoshiri ... M 1344 h	0.1466	0 2378	8.75	52 90	6.61
14. Minagoya ... M 1381 u	0.0084	0.0136	0.50	3.03	0.38

Omitting all results from the outskirts of the field, and taking only the more reliable of those obtained by the washing of large samples of gravel, on the main terrace; we will have the following series, arranged according to position, those of the upper valley first.

Locality of sample.	*Grammes of Gold to one cubic metre.*	*Value of one cubic metre cents.*
Sanjiurono M 1?69 q	0.0319	1.89
Do. M 1360 p	0.0220	1.31
Shikubeno M 1389 c	0.0170	1.00
Yunoshiri, M 1376 s	0.0101	0.60
Do. M 1377 t	0.0094	0.56
Minagoya M 1381 u	0.0084	0.50
Average	0.0164	0.94

These results are probably the most reliable, and will give the true average value of the field, as above. In English and Japanese units this average would be.

One *riu-tsubo* contains 0.0266 *momme* gold, worth 5.9 sen, or one cubic yard contains 0.2 grains of gold, worth 0.74 of a cent.

It will be noticed that the value of the gravel decreases from the upper end of the valley down stream, those from the head of the valley being richest (omitting the exceptional result obtained at Yunoshiri) and those nearest the sea, the poorest.

In conclusion, it seems hardly necessary to remark that these results show that neither the whole field, nor any large part of it, can ever be worked with profit at the present prices of labor. There is evidently a small area of ground near Yunoshiri, possibly as much as a thousand square metres, though probably much less, which will yield $8\frac{3}{4}$ cents per cubic metre; but there is no water convenient, and the gravel might have to be carried on pack horses, or by carts, to the stream below. It certainly would not be advisable to bring water, by a ditch, to this point, as the area of rich ground is too small to warrant such expense.

Topographical Survey.—In order to economize time, the survey was made on a plan, differing somewhat from that adopted in surveying the Toshibets field, the previous season. The exact area of the terraces being the important point to be determined, and the topography of the hills being of less consequence, the following plan was adopted.

Signals marked by small flags were established on the tops of the hills. The "main line" was run on the terrace with the transit, its course being so selected as to take advantage of the best ground, and bending several

times to follow the windings of the valley. The distances were measured with the telescope by stadia-rod as usual. From this line; the terrace being quite free of bamboo, and having but narrow belts of trees in places; the signals on the hills were readily seen, and their positions determined by sights with the transit, from convenient points, three or more such "cuts" being taken on each signal.

The main river, and some of the smaller streams, the roads, and the outlines of the terraces and old workings; were run by prismatic compasses, with paced distances; and the work connected as often as possible with the main line, or the signals determined therefrom. When it was impracticable to make such connections, as in the upper parts of the small branch streams; sights taken on three or four signals, from convenient points, with the compass; served a very useful purpose as a check.

Leveling.—The main line, and other important lines of the survey, were leveled by hand levels with a "speaking" rod (read by the surveyor himself at short distances). The heights of the hills were determined by trigonometrical leveling, the angles of elevation being read by the transit.

In the upper part of the field it was found impracticable to run a "main line" from which the signals on the hills could be seen. This part of the valley was therefore surveyed by triangulation, signals being determined both on the hills and on the terraces. A section of the main line was used as a base and some of the old signals served as checks on the accuracy of the work. The paced lines run by prismatic compass; in this portion of the survey were checked by connections with the signals on the terrace, but more often by cuts taken on three or more signals on the hills.

In this section of the survey I had the opportunity of

comparing the lines of hand-leveling, with the levels obtained by vertical angles read with the transit. The agreement proved quite satisfactory. In a long line, of nearly two miles, leveled by hand, the total error was 1.5 feet; and at intermediate stations, the discrepancy was about the same, except in one instance where it reached 2.2 feet. This would not do, perhaps, for railroad or canal work, but for our purposes it is quite accurate enough, these discrepancies being within the probable error of the trigonometrical leveling itself.

Mapping.—The map was drawn on a scale of $\frac{1}{1000}$. In plotting the work of the transit, the "cuts" in the hills proved to be quite as accurate as it was possible to draw them, and the three or four lines almost invariably passed through the same point, or where a triangle of error was formed it was of insignificant size. This work both in the field, and in the office, was done by Messrs. Nakano and Inagaki, and speaks well for their care and skill. The compass surveys were checked so often by closing on the main line and signals—that as plotted on the map they cannot be greatly in error at any point. The "cuts" taken with the compasses, proved of great value; the true position of points on the paced lines, being thus determined with great accuracy. Finally after the lines of the survey were inked, and the contours drawn from sketches in the note books, the sheets of the map were taken into the field and corrected by actual comparison with nature.

The surveys of the outlines of the terraces made it possible to draw them with some accuracy—and the map represents truly the size of the gold-bearing portion of the field.

Upon examination of the map we find; excluding the poorer ground of the hills and high table lands, and that

of the tributary valleys; the total area of the gold field, within the limits of the survey, to be

7,975,000 square metres.

of this the area of the low bottom land, including the river bed and adjoining flood plains, will be about

3,875,000 square metres.

and the remainder.

4,101,000 square metres,

is the area of the main terraces. Of this an area of about

868,000 square metres

is covered by old workings, leaving a total.

3,233,000 square metres

of untouched terrace, available for gold washing, with an average thickness of 2.4 metres of gravel.

The old workings are confined to the upper part of the valley, being most abundant where the gravel proves to be richest.

It will interesting to calculate, how much gold the party of gold washers from Chikuzen, must have obtained from this part of the field. Taking the average thickness of the gravel at 1.8 metres we will have something over a million and a half cubic metres of gravel, represented by the area covered by these old workings. Multiplying this by the average value of one cubic metre in this part of the field, say 1.4 cents, we will have, as the total amount of gold obtained by Mr. Araki, a value of twenty-one thousand dollars (21,000 *yen*) representing a weight about nine of and a half thousand *momme*. (114. oz. gold.)

Let us suppose that six hundred of the eight hundred coolies were working continuously at this place, and that they worked two hundred and fifty days per year, each washing three cubic metres of gravel per day. At this rate they would wash 450,000 cubic metres of gravel per year, and it would require three years and a third to

to complete the work. This estimate of the amount of to labor be had from six hundred coolies, is extremely liberal, and and if we add the time taken to dig ditches, and to perform other unprofitable work, it is likely that the time will be more nearly four or five years.

We might continue this calculation and prove that the Messrs. Araki must have obtained about two thousand momme of gold per year, or at rate of about twenty-six hundred momme in the thirteen years of their stay. It becomes evident that they must have worked in other places, than in this part of the Musa Valley ; and very possibly the Matsumai field may prove to have been washed by them.

TOKACHI GOLD FIELD.

THE TOKACHI GOLD FIELD.

The attention of the Kaitakushi was directed to this gold field, by the statements of an officer of the Boussan-kioku, who reported having washed a large quantity of gravel on the sea-shore in the vicinity of the Tokachi river, on the east coast of the island. The results obtained by this officer indicated a gold field of extraordinary richness. Unfortunately I have not been able to secure a copy of his report, but have heard on good authority that he obtained $\frac{1}{30000}$ part of gold from a weighed quantity of gravel. This, if correct, would equal thirty three and a third grammes per ton, or about sixty six and two thirds grammes, per cubic metre. Assuming the gold to be of the same fineness as that of the Toshibetsu, this would be equivalent to nearly forty dollars per cubic metre!

After leaving the Musa gold-field we proceeded to the scene of this remarkable discovery; the verification of which, promised to be truly refreshing, after the sight of so much gravel, yielding but one or two cents to the cubic metre.

The journey, though long and fatiguing, was not without interest, but the description of the country, and the geological facts collected, must be deferred to another time and place.

The deposit of gravel, which forms the Tokachi gold field, was was first met with at one *ri* beyond Samani, near Uragawa, in the province of Hitaka; and on the south-west side of the prominent range of mountains of metamorphic rock, which terminate in the promontory of Erimo, at the south east corner of the island.

The gravel is here about forty or fity feet thick, and forms nearly the whole height of the marine terrace. This bed of gravel is usually underlaid by a dark blue slaty rock, which is readily decomposed, and forms in places a large proportion of the gravel. This slate seems to contain a little gold. A sample of slate debris, unmixed with other gravel, was tested, being taken from the bed of a small stream, Shimichikayopu, which runs through the metamorphic rock, between Samani and the place of the first appearance of the drift. One half cubic metre of this slate yielded four and one tenths milligrammes of gold, or eight and two tenths milligrammes to the cubic metre. The quantity of decomposed slate available is very small, even were it rich enough to pay for treatment. There is of course, an inexhaustible supply of the solid, undecomposed slaty rock, but probably even poorer than the gravel.

A sample of gravel from the bed of drift, was tested on the Sannishibe, a small stream a short distance east of the Shimichikayopu. The gravel is here composed of hard laminated sandstones, mica schist, quartzite, slate, etc., and contains a large proportion of quartz pebbles. The bedrock is the same partially decomposed, slate like rock, here filled with numerous thin quartz seams and small veins. The gravel contains a large proportion of this slate, being in places quite blue in consequence.

Two cubic metres of gravel, taken from the bedrock upward, in a favorable place about thirty cho (2 miles) up

stream; yielded but one or two small grains of gold, too small to be weighed. This result would seem to indicate that the gravel of the drift deposit, merely dilutes the debris of the blue slate, and probably owes all its gold to the blue gravel which it contains.

On one or two small streams in this vicinity I observed doubtful evidences of old workings. So it may be, that some of this gravel is richer than that tested, though not likely to be rich enough to be now worked.

Between Samani and Horoidzumi we cross a range of mountains parallel to the main range, and like that, composed of metamorphic rock. The bed of gravel rises gradually with the slope of the mountains, to a height of about three hundred feet above the sea; preserving nearly the same thickness, forty or fifty feet, as before, and forming in places, extensive table lands on the flanks of the hills. Several fine sections are exposed on the sea-coast. High bluffs of metamorphic rock, covered at the top with this thick bed of stones and gravel, presenting a face seemingly as perpendicular as the wall of rock itself. The occurrence of this bed of gravel, thus raised in the hills, seems to point to a recent elevation of this range since the deposition of the drift.

Horoidzumi is on a marine terrace of some extent made up entirely of drift, and surrounded by metamorphic mountains. There are two sea terraces here, one perhaps fifty feet above the sea, and the other one hundred and fifty to two hundred feet.

A sample from this upper terrace was washed on Abiakisawa, a small stream twenty five or thirty *cho* north-east of Horoidzumi, and at a point about ten *cho* from the coast. The bedrock, dark blue argillite and quartzite, is here about twenty five or thirty feet above the stream, and the gravel ten feet thick, covered by two feet of black loam. A large quantity of gravel, not mea-

sured, but between three and four cubic metres, was taken from the top of the bluff and washed in the stream below. Although great care was exercised in the washing, no gold was obtained, but only the usual iron-sand, which in this case was both abundant and coarse.

Another sample was taken from the side of a small ravine near Nochinai, about half a *ri* north-east of Horoidzumi and very near the shore. The bedrock of this lower terrace was nowhere seen, and the gravel is from forty to fifty feet thick, forming the whole height of the terrace. We washed here about one cubic metre of gravel, but without obtaining any gold. The iron sand was quite coarse.

Between Horoidzumi and Saruru we crossed the main range of mountains, composed of mica-schists gneiss, granite, quartzites, etc., and having a northwesterly trend.

Saruru, in the province of Hitaka, is at the mouth of a river of the same name. In descending the valley several terraces, covered with promising gravel, were noticed. Four small samples of this gravel from different places, were afterwards carefully tested for gold, but proved barren; and finally a sample, measuring about half a cubic metre, was secured from a hollow in the bedrock, near the head of the terraced portion of the valley, under conditions which would usually assure a very large yield. The sample being washed with care, no gold whatever was found.

From Saruru we went to Birō, the principal town of the province of Tokachi. Birō is situated on a high marine terrace on the coast, and a short distance north of the last range of foot hills of the mountain range. The terrace is almost wholly made up of gravel, in places fifty or sixty feet thick. About one cubic metre of gravel, not

measured, was washed on the Birō river, but no gold was obtained.

Securing a guide at Birō, we went on to Berufune, near which place Mr. Enomoto washed for gold the year before. The gravel here, is like that of Birō, though containing a very small proportion of quartz in addition The bedrock is probably far below the level of the sea as it is nowhere to be seen, and as the terrace is here quite low, having decreased in height from Biro.

At Ayoboshuma, one *ri* from Berufune, or about six *ri* north of Biro, the place reported to be so very rich, the gravel is only about twenty-five to thirty feet above the sea, and is covered by a few feet of yellow sand. The gravel is composed of blue metamorphic quartzites and slates, and a small percentage of granitic rocks, with still less quartz, though more than at Berufune. The bedrock was not seen. The guide showed us about the place from which Mr. Enomoto took the sample of gravel, which yielded so much gold; but the wind and tide had obliterated all trace of his work. A place was chosen in the immediate vicinity; but at a lower level, as it was desired to push the excavation as near as possible to the bedrock. Three cubic metres of gravel were washed; taken from eighteen feet above, to four feet below the surface, from every part of the bed. Thus a thickness of twenty two feet was tested, the lower portion of which was far lower than any depth that Mr. Enomoto could have attained, at the place from which his sample was taken. This gravel was washed in a little stream issuing from springs in the bank, and flowing over the shore. The large stream near by, being both too deep and too sluggish.

These three cubic metres of gravel, yielded about twenty grains of gold; many of which were so minute as to be seen with difficulty, even with a strong lense; and all

being exceedingly fine. These grains together weighed only six-tenths of a milligramme, or at the rate of two-tenths of a milligramme per cubic metre. Expressed fractionally this would be the

$$\frac{1}{10,000,000} \text{ part}$$

by weight, of the gravel tested!

Another smaller sample was taken from this same locality, as nearly as possible from the exact place worked by Mr. Enomoto last year. But with no better result.

Near the mouth of the Tobui river, one *ri* beyond Ayoboshuma, or about seven *ri* (17 miles) from Biro northward, there is an exposure of bedrock, a clay rock here forming the bank of the river. A specimen of gravel, about one quarter cubic metre, taken from the surface of this bedrock, yielded upon being washed two microscopic grains of gold, so small as to be unweighable.

The following table gives a summary of the results obtained from the different localities in which this deposit of drift was tested, beginning at the northernmost.

TABLE VII.—TOKACHI GOLD FIELD.

Place.	*Grammes of Gold per cubic metre.*	*Value of 1 cu. metre in cents.*
Tobui river, Tokachi Province	0.0001	0.01
Ayoboshuma, „ „	0.0002	0.01
Biro river, „ „	nil.	nil.
Saruru river, Hitaka Province	nil.	nil.
Nochinai, „ „	nil.	nil.
Abiaki river, „ „	nil.	nil.
Sannishibe, „ „	trace.	nil.
Shimchikayopu* „	0.0082	0.50

From these results it is evident that this deposit

* From decomposed slate.

of gravel, which covers so large an area in these two provinces, is nowhere rich enough to pay the expense of washing, and that even the occurrence of the minute proportion of gold found is quite exceptional. It is however quite possible, that had the concentrated iron sand from each place, been scrutinized with the care observed at Ayoboshuma; an equal quantity of gold might have been collected at some other places, for such microscopic grains are very easily overlooked.

In view of these results it seems, therefore, not a hazardous supposition, to imagine that the gold washers, employed by Admiral Enomoto, men living in Hitaka province, either thinking to please him, or for some other object, such as the hope of employment from merchants or other gold-seekers; quietly dropped the gold sand in question into the gravel during the operation of washing! I have not been able to examine the gold obtained, but am informed that it is quite unlike the gold of Yesso, and resembles very strikingly the gold sand of the island of Sado.

Five or six years ago, some merchants from Hakodate, attracted by rumors of gold in this vicinity, began to work the gravel between Berufune and Ayoboshuma, but soon abandoned the attempt, undoubtedly finding the ground too poor. It is supposed that they dug the ditch which crosses the terrace here, probably to take water from the upper part of the Ayoboshuma valley.

In concluding this report I take pleasure in acknowledging the services of the officers and student-assistants, who have been associated with me in this work, who have cheerfully undergone fatigue and hardship, and who have so creditably performed the work committed to them.

The following gentlemen have assisted me in this work:—

Season of 1873.

Mr. Ijichi, Suyemasu, Paymaster.
Mr. Sato, Hideaki, Interpreter and Assistant.
Mr. Inagaki, Tetsunoshin, Student Assistant.
Mr. Misawa, Shijō, „ „
Mr. Kada, Sadaichi, „ „
Mr. Saka, Ichitaro, „ „

Season of 1874.

Mr. Machida, Sanetomo, Paymaster.
Mr. Nakano, Toshio, Interpreter and Assistant.
Mr. Kubota, Masafusa, Draughtsman,
Mr. Inagaki Tetsunoshin, 1st Student Assistant.
Mr. Takahashi, Jōzō, Student Assistant.
Mr. Saitō, Takeharu, „ „
Mr. Mayeda, Semei, „ „
Mr. Shimada, Junichi, „ „

It would be difficult to single out for praise any one of these, so well have all done their work; so I must be content with this general acknowledgement of their services.

Respectfully submitted,

HENRY S. MUNROE.

COMMISSIONER CAPRON'S NOTE CLOSING THE VOLUME.

On the 28th of March, His Imperial Majesty, the Tennô, in anticipation of Commissioner Capron's departure for America, extended to him an audience, at which His Majesty was pleased to address the Commissioner in the terms which follow.

It has been thought best to append the address of His Majesty to this volume, because it is properly a portion of the history of which these reports and letters are at the best but a brief *resumé*, and because, moreover, it discloses the gratifying fact that the task which has been undertaken in Yesso receives the attention which its importance to the Japanese nation at large merits.

ADDRESSS OF THE EMPEROR TO COMMISSIONER CAPRON.

ADDRESS OF HIS IMPERIAL MAJESTY THE TENNO OF JAPAN,

(Translation.)

Since your engagement with the Kaitakushi, intrusted as you have been with the work for the settlement and development of the Island of Hokkaido (Yesso) you have so assiduously and faithfully executed your responsible duties, and advised the Chokuwan, that the important work of the department has been successfully carried out and it is daily progressing to our satisfaction. Indeed your services were valuable and deserve my high appreciation, and it is hardly a matter of doubt, that the future progress of that Island, the fruit of your labor, will much advance the happiness of my whole Empire.

Now, on your return to your country, on the termination of your engagement, I have to acknowledge your valuable services, and wish to express my good wishes for your future prosperity and happiness.

ERRATA.

Page 7, line 9, 6 for 5.
,, 65, ,, 36, *transcript* for *transcription*.
,, 79, last line, *period* at the end.
,, 84, line 4, *form* for *from*.
,, 99, 1873 for 1874.
,, 103, line 33, *so* for the first *as*.
,, 110, ,, 27, *Böhmer* for *Behmer*.
,, 221, ,, 25, *procedure* for *proceedure*.
,, 214, ,, 2, for *Ikunoski* read *Ikunoske*.
,, 220, ,, 8, for *survey with* read *survey of*.
,, 220, ,, 21, for *stadial* read *stadia*.
,, 304, ,, 15, for *Vamanashi* read *Yamasashi*.
,, 314, ,, 1, for Yamanashi read Yamasashi.
,, 150, ,, 16, for 4,300 read 43,000.
,, 152, ,, 2, from bottom for *some* read *same*.
,, 616, ,, 8, *photographic* for *photographing*.

At bottom of page 182 insert the following paragraphs omitted by copyist:—

Kindles quickly and burns readily with a short feeble flame, somewhat luminous and quite smoky. The lower bench burns rather better than the others. The coal falls to pieces in the fire.

Ash rather heavy and contains considerable unburned cinder, mainly from upper and lower benches; coal does not coke.

On table III, opposite page 196. The reference "2" in the heading to the last column should be "1".

RESULT OF NINE YEARS' METEOROLOGICAL OBSERVATIONS AT HAKODATE (PAR.); LATITUDE 41° 46′ 0″ N., LONGITUDE 140° 44′ 30″ E.

		JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY.	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.	YEAR.	
Temperature of the air (Fahrenheit's Thermometer)	Mean	27.61	30.71	34.87	43.16	53.71	59.7	66.79	70.49	64.81	53.59	41.50	32.81	46.39	See Note A.
" " "	Extreme { Maximum	49.50	49.07	60.00	69.80	79.00	79.0	86.50	88.00	92.00	79.00	61.00	50.00	93.00	
" " "	Minimum	2.00	5.50	13.00	23.00	31.00	42.5	48.50	54.00	43.50	32.00	18.00	8.00	2.00	
Barometer, reduced to the Freezing point (32° F.) and sea level		29.892	29.897	29.926	29.892	29.934	29.84	29.825	29.817	29.903	29.907	29.907	29.891	29.896	See Note B.
Hygrometer, dry bulb thermometer		29.12	32.50	36.80	47.30	57.89	60.1	71.55	75.83	66.40	54.93	42.50	33.93	53.20	
" " "		27.20	30.04	33.80	44.53	51.80	58.1	67.34	71.13	63.10	52.40	40.34	32.82	47.86	See Note C.
" " "	Tens of vapor in English inches	0.184	0.141	0.170	0.219	0.362	0.44	0.601	0.723	0.579	0.353	0.213	0.172	0.367	
" " "	Relative humidity in hundredths	77.50	77.00	80.20	77.20	86.70	91.1	78.00	87.50	85.40	81.00	78.00	83.33	82.23	
Rain, average number of days		2.4	1.3	4.3	9.0	9.9	10	10.4	12.9	12.3	10.3	8.1	6.2	86.20	See Note D.
Snow, " " "		14.8	9.72	7.87	1.8	.09	...	...	...	...	.10	4.3	10.17	48.84	
Rain fall and Melted snow in English inches		3.963	2.967	2.240	2.521	2.475	4.33	3.023	8.520	5.56	4.74	4.52	3.53	71.307	
Clouds and Over cast, number of days (12 hours)		20.17	15.02	16.68	13.72	13.27	16.1	13.90	21.33	17.01	19.61	23.01	23.16	221.09	See Note E.
Amount of clouds per day (12 hours)		.62	.47	.53	.44	.43	...	.50	.65	.58	.60	.80	.62	.57	
Fog and haze, average number of days (12 hours)		...	.14	.88	1.78	2.86	4.1	6.85	.78	...	.55	.09	.09	15.59	
Winds, general Directions	S	4.08	6.60	4.58	5.10	1.72	1.1	.74	1.90	2.81	3.32	.51	6.93	43.30	See Note F.
	E	2.88	2.63	3.24	6.80	8.84	11.1	14.93	13.67	8.58	5.39	2.93	1.93	81.34	
	N	1.93	1.89	4.82	7.28	8.83	7.1	6.29	7.38	4.39	4.43	4.13	2.29	63.84	
	W	17.19	12.83	13.78	9.02	7.46	5.1	4.00	3.80	8.04	12.18	15.01	16.83	119.27	
Calm, average number		3.41	1.07	1.18	1.23	0.81	1	0.81	1.33	1.78	1.17	1.08	1.07	16.79	
Velocity of wind, number of miles travelled		44.04	30.24	17.340	120.09	81.63	86.1	96.937	92.939	103.180	82.039	83.194	39.092	932.81	See Note F.

Note A.—The *Temperature* is deduced from daily observations of registering Thermometers during *Nine* years 1869-69 (Rem. Dr. Albrecht), 1869-69-70-71 (Capt. Thomas Blakiston) 1872-73-74 (Fukusi Naritoyo).

Note B.—The *Barometer* is deduced from daily observations of an aneroid (No. 20,132) during *Seven* years 1868-69-70-71 (Capt. Thomas Blakiston), 1873-73-74 (Fukusi Naritoyo), during which period the extreme range was 29".11 and 30".406. The instrumental correction of the aneroid (No 20,132) was determined by comparison with the standard mercurial Barometer (No No. 1345). *Counted for Temperature and reduced to the sea level.*

Note C.—The *Hygrometer* is deduced from daily observation during *Two and a half years* 1872-73-74, and the form of vapor and Relative Humidity is reduced from Psychrometrical Tables by A. Guyot.

Note D.—*Rain and Snow* deduced from daily observations during *Twelve* years, 1860 (Rem. Dr. Albrecht), 1864 to 1871 (Capt. Thomas Blakiston), 1872 to 1874 (Fukusi Naritoyo); *rainfall and melted snow* are deduced from daily observations during *Two and half years* 1872 to 1874, by self-registering Fleuscy's Gauge.

Note E.—The result for *cloudy and overcast weather* is deduced from *daily observations during Four years* 1871 to 1874.

Note F.—*Fog* and *Wind* record is the result of *Eleven years* observations from 1864 to 1874.

FUKUSI NARITOYO,
Observer

TOKIO, 13th, 3rd Month, 8th Year of Meiji.

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